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Advanced Recovery Systems Wind Tunnel Test Report

R. H. Geiger and W. K. Wailes

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Pioneer Aerospace Corporation Melbourne, Florida

Prepared for Ames Research ⊕nter CONTRACT N 8-36631 August 1990



Arnes Research Center Moffett Field, California 94035-1000



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LIST OF TERMS AND SYMBOLS

a Distance between the point at which Fu attaches to the parafoil and the

point at which Ru passes through the PACS top plate, ft

AREF Reference Area(s), sq-ft b Span of parafoil, ft

c Chord of parafoil, ft
CD, CD Drag coefficient

CL, CL Lift coefficient

C_I, CMX Rolling moment coefficient

CLDi Control line load coefficient (i = 1 to 2)

C_M, CMY Pitching moment coefficient
C_n, CMZ Yawing moment coefficient

Cy, CY Side force coefficient

CTLi Control line deflection (i = 1 to 2), in.

C.P. Confluence point

C/4, Q.C. Quarter chord of parafoil

C.G. Center of gravity

CX Distance between Fu and Ru on the parafoil keel, ft

D Drag, lbf

Fu Leading edge exposed riser length, ft FCLDi Force in control line (i = 1 to 2), lbf FRISEi Force in riser (i = 1 to 20), lbf

FRISEi Force in riser (i = 1 to 20), lbf
FTETHI, Ti Force in lateral tethers (i = 1 to 4), lbf

i, ia Parafoil rigging angle (angle between line perpendicular to the parafoil keel and

a line from the quarter chord to the confluence point), dea

k Keel length, ft

Li Riser line distance from bottom of parafoil to bottom of PACS bottom plate, ft LoF(i), F, R Riser line distance from top of PACS top plate to bottom of bottom plate, ft

L/D Lift to drag ratio

I. Lift Ihf

LREF Reference Length (c for longitudinal, b for lateral), ft

L.E. Leading edge riser line

L, LBAR Distance from PACS pivot point to weight centroid, in.
LR Length of riser from parafoil to confluence point, ft

LA Total exposed riser line length, ft

LP Distance from top of PACS to plate to confluence point, ft

MRP Moment reference point

PACS Parafoil attitude control system

q Dynamic pressure, psf

RISEI Riser load coeffocient (i = 1 to 20)

Ru Aft exposed riser length, ft

LIST OF TERMS AND SYMBOLS (CONTINUED)

Planform area of parafoil, sq-ft

TETHI Lateral tether load coefficient (i = 1 to 4)UVI Unit vector for each tether (i = 1 to 4)Weight of PACS without struts, lbs. Wpacs

XCP, XCP Center of pressure location, in.

Location of airfoil as a portion of chord, x direction x/c

X, XBAR X-axis weight centroid of PACS, in.

XX Distance between Fu and Ru on the PACS top plate, ft Xf Distance from PACS hinge to leading edge riser hole, ft y/c Location on airfoil as a portion of chord, y direction

Z, ZBAR Z-axis weight centroid of PACS, in.

GREEK TERMS AND SYMBOLS

Angle of attack of the parafoil (measured from keel of parafoil to freestream or ALPHA velocity vector), deg. Angle between the top plate of the PACS and the tunnel floor, deg. op, ALPHAP Angle between top plate and the line from the PACS pivot point to the PACS γ weight centroid deg. δ_o, DELP Angle between the top and bottom plate of the PACS, deg. 0, THETA

Angle between the leading edge/centerline riser and the top plate of the PACS

in the spanwise direction, deg.

φ, PHI Angle between the leading edge/centerline riser and the top plate of the PACS

in the chordwise direction, deg.

FOREWORD

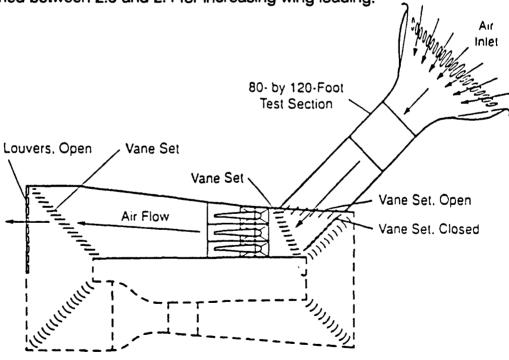
This document presents the results of wind tunnel testing performed under the Phase 2 option of contract NAS8-36631, Advanced Recovery Systems for Advanced Launch Vehicles. It satisfies the requirements for reporting wind tunnel data under the ARS contract.

1.0 SUMMARY

Pioneer Aerospace Corporation (PAC) conducted parafoil wind tunnel testing in the NASA-AMES 80 X 120 test section of the National Full-scale Aerodynamic Complex, Moffett Field, California (Fig. 1.0-1). The investigation was conducted to determine the aerodynamic characteristics of two (2) scale ram air wings in support of air drop testing and full scale development of Advanced Recovery Systems For The Next Generation Space Transportation System.

Two models were tested during this investigation - The primary test article, a 1/9 Geometric scale model with wing area of 1200 square feet and secondary test article, a 1/36 geometric scale model with wing area of 300 square feet, both of which had an aspect ratio of 3.

The test results show that both models were statically stable about a model reference point at angles of attack from 2 to 10 degrees. The maximum lift-drag ratio varied between 2.9 and 2.4 for increasing wing loading.



80- by 120-Foot Wind Tunnel Operation

FIGURE 1.0-1, NATIONAL FULL-SCALE AERODYNAMIC COMPLEX

2.0 INTRODUCTION

Pioneer Aerospace Corporation (PAC) was selected by NASA's MSFC to investigate promising concepts for recovering valued assets from the Next Generation Space Transportation System. Reuse of selected STS elements (such as core stages, upper stage propulsion/avionics modules, booster stages, booster P/A modules, and fuel-oxidizer tanks) is critical to a low cost space transportation system. Reuse inherently requires recovery, retrieval and refurbishment. Therefore, development of advanced recovery systems for high cost launch vehicle components, along with the ability to recover at selected sites, to refurbish rapidly, and reuse certain vehicle components is needed to provide an efficient operating system with minimal overall program cost. Through Phase 1 concept identification and preliminary trades analysis tasks. Pioneer identified "best candidate" recovery system concept for a list of prospective recoverable STS elements. ARS Phase 2 will demonstrate the Advanced Recovery Systems ability to precisely and controllably soft land an emulated P/AM which in full scale, would weigh approximately 60,000 pounds. This requires employment of a controllably maneuverable Ram Air Inflated Wing whose size and weight characteristics are well beyond today's state-of-the-art. An orderly program has been planned which includes analytical modeling, scale model tow testing, wind tunnel testing and air drop flight testing. The demonstration culminates in a flight test of a full-scale Ram Air Inflated (Parafoil) prototype system.

2.1 BACKGROUND

Prior to the selection of a Ram Air Inflated Wing for this program, various recovery methods were considered. Among those considered were a Ballistic (L/D=0) Parachute System and a Low Glide (L/D=1) Parachute System. For both the Ballistic and the Low Glide systems, a huge data base exists upon which to build, making either of these systems relatively low risk. Along with the low risk factors which these two systems share, the data also show that each system carries a large weight penalty and has very little or no capability to maneuver. Both systems are good, reliable decelerators but have almost no target acquisition capability.

The Ram Air Inflated Wing has many advantages over the more conventional Parachute system such as low weight, high maneuverability and the capability to flare for a soft, stable landing. However the vast majority of the data base for Ram Air Inflated Wings is for small (personnel size) systems. Going beyond the personnel sized canopies (175 to 340 ft²), some very limited research has been done on Ram Air Inflation Systems up to 3200 ft². The canopy size required for this test program must go far beyond any that have been previously studied. The full scale prototype (10,800 ft²) exceeds the size of 3,200 ft² by 338%.

Several wind tunnel investigations were conducted in the 1960's in the University of Notre Dame 2' X 2' test section by John D. Nicolaides⁴ and in the NASA Langley 30' X 60' (elliptic) test section by George M. Ware and James L. Hassell, Jr.⁵. These wind tunnel tests were conducted on models at relatively low wing loadings (1-2 PSF) and small size models up to 300 ft². Due to the lack of data for ARS size Parafoils a large scale wind tunnel test was conducted to establish a data base of large (1,200 ft²) Ram Air inflated wings.

2.2 TEST SITES AND DATES

This wind tunnel test program is sponsored by NASA-MSFC with Pioneer Aerospace Corporation being the prime contractor. Lockheed Missiles and Space Company is a sub-contractor whose primary wind tunnel related task is development of the wind tunnel interface, Parafoil Attitude Control System (PACS). The wind tunnel testing was conducted during the month of September 1988 in the 80' X 120' test section of the National Full-Scale Aerodynamics Complex (NFAC) at the National Aeronautics and Space Administration's (NASA) Ames Research Center (ARC), Moffett Field, California.

3.0 OBJECTIVES

The objective of the wind tunnel test was to obtain data in support of air drop flight testing and development of a full-scale Ram Air Inflated prototype Advanced Recovery System.

3.1 BASIC IN-PLANE LONGITUDINAL AERODYNAMICS

The first primary objective was to obtain basic in-plane longitudinal aerodynamics, ie., lift, drag and pitching moment data. These data were obtained over a range of angles of attack from approximately zero to stall (0 to 10 degrees). This range was selected to support the basic gliding flight and rigging requirements of the air drop test program.

3.2 FLARE DATA FOR TRAILING EDGE DEFLECTIONS

The second primary objective was to obtain data to support the flare maneuver. Lift, drag and pitching moment data was collected for various trailing edge deflections and angles of attack. Associated control line loads were also measured for all deflections.

3.3 CONTROL DATA

The last primary objective was to obtain data to support the sizing of the control mechanisms for the drop test. Control line loads as a function of displacement and incremental changes in longitudinal aerodynamics was acquired for various control methods. As a secondary objective associated lateral aerodynamic forces and moment were obtained for different control methods. Figure 3.3-1 shows the different control methods.

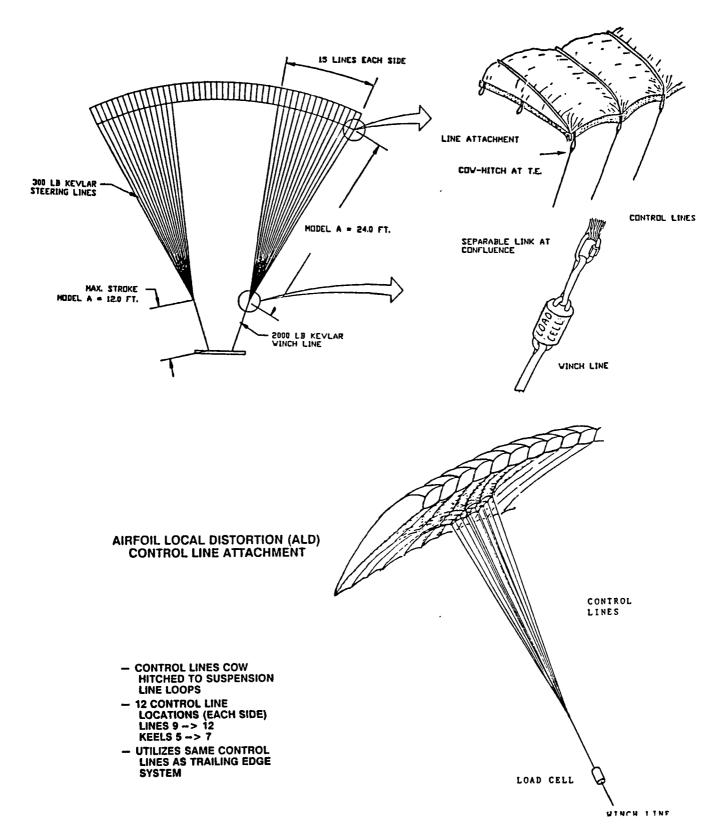


FIGURE 3.3-1, TRAILING EDGE STEERING, L/D MODULATION LINE ARRANGEMENT

3.4 LOAD DISTRIBUTION

The load distribution across the wing is needed for canopy and suspension line design of drop test and eventual full-scale models. The distribution of the load on the parafoil was measured by placing load cells in chordwise and spanwise locations in the suspension lines and data obtained for all configurations.

3.5 SCALE EFFECTS

A review of past programs indicates that there is often a scaling problem associated with flexible wings. Therefore the next objective of the test was to obtain data on scale effects to aid in scaling the data up to full scale. This was accomplished by testing a second model one half the linear scale of the primary model. Testing of the smaller model was limited to selected test conditions. Table 3.5-1 shows an overview of how and when each objective was met.

DATE	RUN #	Q	OBJECTIVE	COMMENTS
8 SEPT.	1	3	TRIM PARAFOIL	FIRST RUN
9 SEPT.	2 3	0 6	CALIBRATION LONGITUDINAL AERO	PACS/INSTRUMENTATION CALIBRATION
12 SEPT.	4	6	LONGITUDINAL AERO	
13 SEPT.	5	6/9	LONGITUDINAL AERO	FINAL TRIMMING OF PARAFOIL
14 SEPT.	6	6	FLARE DATA	
15 SEPT.	7	0	CALIBRATION	
19 SEPT.	8	3	PHOTOGRAPHS	
20 SEPT.	9 10	9	LONGITUDINAL & FLARE AERO FLARE DATA	
21 SEPT.	11 12	6 6/9	CONTROL INPUTS CONTROL/FLARE	TRAILING EDGE DEFLECTORS
22 SEPT.	13 14	6 9/12	CONTROL INPUTS CONTROL/LONGITUDINAL DATA	AIRFOIL LOCAL DISTORTION
23 SEPT.	15	6/9/12	PACS AERODYNAMICS	PARAFOIL REMOVED
27 SEPT.	16	3/6	TRIM PARAFOIL	SMALL PARAFOIL
28 SEPT.	17	6	LONGITUDINAL AERO SCALE DATA	

TABLE 3.5-1, WIND TUNNEL TEST OVERVIEW

4.0 TEST FACILITIES AND TECHNIQUES

4.1 TUNNEL DESCRIPTION

A review of past programs indicates that there is often a scaling problem associated with flexible (Parachute/Parafoil) configurations. Therefore, conducting a wind tunnel test with the largest possible scale model was the main goal. This goal was achieved by selecting the largest available wind tunnel for testing. The newly commissioned 80' X 120' test section of the National Full-Scale Aerodynamics Complex at NASA's Ames Research Center was chosen because it is the largest wind tunnel available. The new 80' X 120' leg is basically an open circuit tunnel with a closed throat test section (Figure 4.1-1). The 135,000 horse power fan drive system is enough to attain speeds at more then 115 MPH, more than enough to achieve the relatively high wing loadings required for this test program.

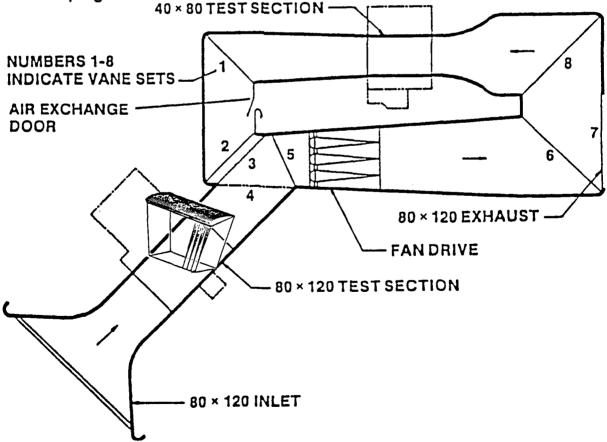


FIGURE 4.1-1, NATIONAL FULL-SCALE AERODYNAMIC COMPLEX

4.2 TEST STAND - PARAFOIL ATTITUDE CONTROL SYSTEM

The Parafoil Attitude Control System (PACS)(Figure 4.2-1) was developed to enable the parafoil to reach its natural trim point and still be able to change the parafoil angle of attack. The PACS includes two carriage struts which attach to the tunnel support/balance system. Each of these struts incorporates a free-floating pivot point which attaches to the top plate of the hinged plate substructure. This point is translated along the top plate by the Xcp actuator mechanism. The hinged plates are driven apart by the L/D actuator. The combination of the Xcp and L/D actuators results in setting the parafoil to the desired attitude. Each plate is divided into removable sections which contain the riser pattern for the parafoil being tested. The suspension lines pass through the top plate and continue through the bottom plate then are attached to the underside of the bottom plate. Two control winches are mounted on the underside of the bottom plate and are used for the various control deflections. Two linear potentiometers monitor the Xcp and L/D actuators. The control winches are monitored by rotary potentiometers while the angle between the leading edge/center suspension line and the top plate (ϕ and θ) is measured by a single joystick potentiometer. An inclinometer was used to measure the top plate angle (ap) with respect to the tunnel floor. A flow deflector was mounted on the tunnel floor just upstream of the PACS to minimize data uncertainty resulting from flow interaction with the PACS. A more detailed description of the PACS is contained in the "Preliminary Analysis of Parafoil Attitude Control (PAC) Model, ARS-WP-09.

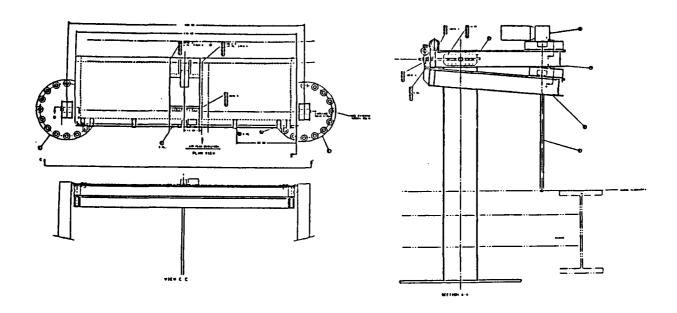


FIGURE 4.2-1, PARAFOIL ATTITUDE CONTROL SYSTEM (PACS)

4.3 TEST MODELS

In keeping with the main objective of this test program, testing the largest possible model, Pioneer designed the largest wing that could effectively be flown in the wind tunnel. The parafoil size was chosen to be as big as possible without interfering with the air flow near the tunnel walls.

The primary test article (Part #7901) was a 1/9 area scale model of the ARS prototype parafoil. The model had a chord of 20 ft and a span of 60 ft, thus having 1,200 ft² area. The parafoil consisted of 47 spanwise cells and was constructed with 1.1 oz/yd nylon. This wing had 960 suspension lines attached in 48 spanwise rows and 20 chordwise columns. Each suspension line was 300 lb Kevlar and each three spanwise groups were cascaded down to one attachment point on the PACS making a total of 320 PACS connecting locations. One of the objectives for this model was to collect data for various symmetrical and asymmetrical trailing edge/control deflections to support the flare and control maneuvers. The wing was equipped with 30 movable/removable control lines that were adjusted using the two winches located on the PACS.

Another of the objectives for this test program was to determine what the effects of size (scaling) are. A 1/36 area scale model (1/4 scale of the primary test article) (Part # 7900) was constructed and tested for this propose. The small model had a chord of 10 ft, a span of 30 ft and an area of 300 ft². This second parafoil was identical to the first parafoil in geometry, material and construction (48 cells, 1.1 oz/yd nylon/300 lb Kevlar and same airfoil section). This parafoil was not equipped with the various control methods. This model was exclusively used to evaluate the scaling effects on wings of this type.

Both models are shown in Figure 4.3-1. A stress and design analysis is contained in "Advanced Recovery System Parachute/Parafoil Stress and Design Loads Analysis", ARS-WP-10 Rev. A.⁷

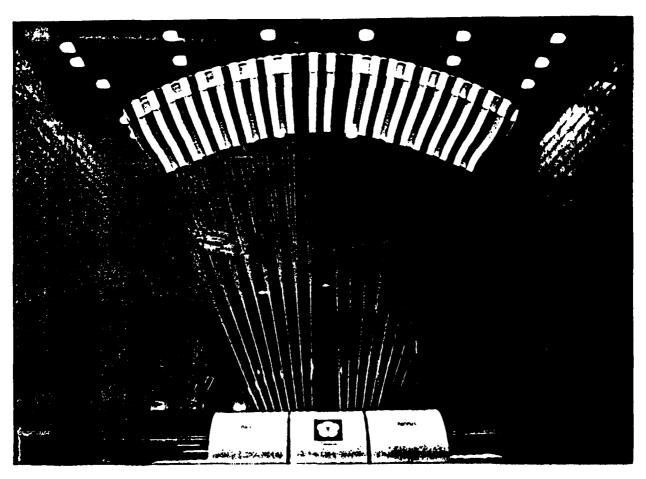


FIGURE 4.3-1, WIND TUNNEL TEST MODEL CONFIGURATION

4.4 TEST TECHNIQUES

Figure 4.4-1 shows the 20' x 60' parafoil during testing. While testing both models were allowed to fly in the wind tunnel by use of a active tether system (Figure 4.4-2). Five ceiling and four side tethers were used to raise the parafoil for initial inflation and to hold the wing to measure lateral loads during asymmetrical control deflections. During most of the testing, once the parafoil reached a stable trim point, all tethered were released to allow the wing to fly unrestrained. A test procedure was adopted during testing that when the parafoil reached stall or any unstable condition the wind tunnel was shut down, the parafoil angle of attack decreased and ceiling tethers tightened. By using this procedure the wing would stabilize quickly and reduce the chance of any damage occurring to the wing.

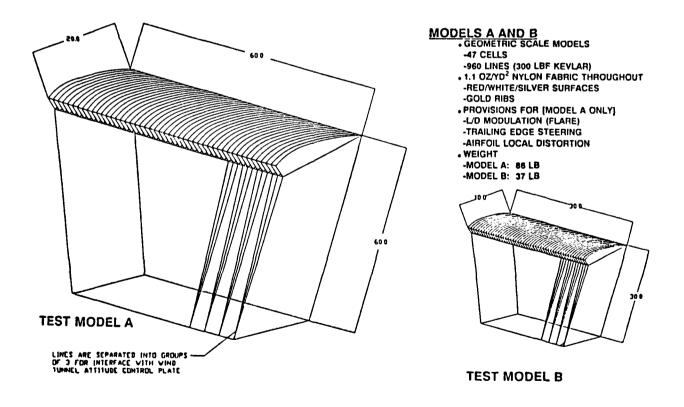


FIGURE 4.4-1, 20' x 60' PARAFOIL

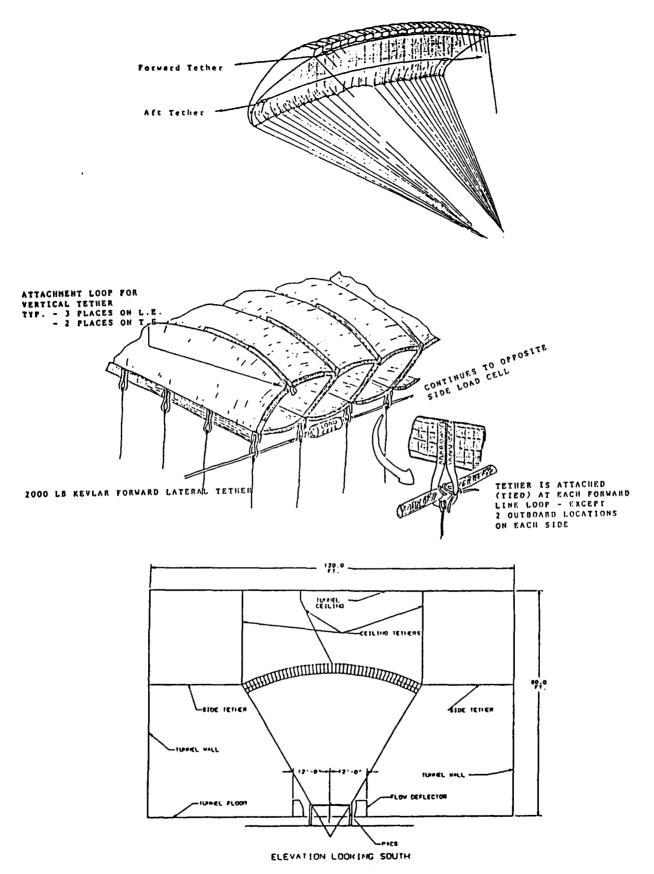


FIGURE 4.4-2, LATERAL TETHER LOCATIONS

4.5 DATA ACQUISITION

The PACS served as the interface between the parafoil and the tunnel's balance/data acquisition system. Lift, drag and side forces were transmitted directly through the PACS to the balance and recorded on the systems computer. Rolling and yawing moments were also measured using the tunnel balance system. The PACS was designed to find the center of pressure of the parafoil by finding the point on the plate where the pitching moment was zero. Then using simple force transformations the pitching moment could be calculated.

Twenty load cells were placed in the suspension lines to give spanwise and chordwise load distribution across the wing. The load cells were connected directly to the tunnels data acquisition system. Four additional load cells were placed in the side tethers to measure side forces during the control deflections. Two load cells were also placed in the two (one each side) control lines to measure the force required for control line deflections.

All data was recorded for each data point on the tunnel's computer. The data was then corrected using the tunnels standard corrections and output on hard copies for further use.

Five video cameras were placed at various locations around the wind tunnel to observe and record the testing. One of the five cameras was located on the west wall, adjacent to the parafoil wing tip. This camera was used as an alternate method of measuring the angle of attack of the wing. The other four cameras were used for documentation purposes only.

4.6 PROBLEMS AND CORRECTIVE ACTION

Several problems occurred during testing. This section describes the problems and the corrective action utilized.

PROBLEM: PACS Xcp Retention Pin Failure - The pin used to hold the Xcp thrust bearing in place sheared during testing. The retention pin design was faulty in that it could not withstand the high shear loads during testing.

CORRECTIVE ACTION: The bearing journal was modified to accept a collar that would fit on both sides of the thrust bearing thus retaining the bearing under high loading conditions. Figure 4.6-1 shows the Xcp retention pin failure and modification used to correct the problem.

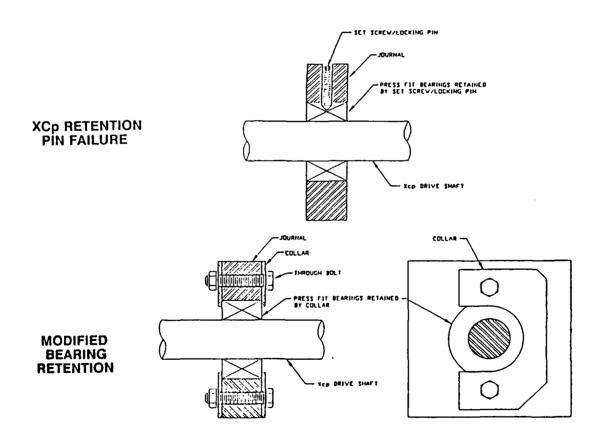


FIGURE 4.6-1, RETENTION PIN MODIFICATION

PROBLEM: Parafoil/Tether Failure - The Parafoil was designed with nine tether attachment locations. The tethers were used to keep the wing from diverging too far once the wing reached an unstable trim point. During testing the tethers encountered loads that were higher than expected. The results were that the parafoil was damaged in the locations where the tethers were located.

CORRECTIVE ACTION: The parafoil was fixed and strengthened at the tether locations using Rip-Stop and Kevlar reinforcing materials. The materials were sewn in place using a sewing machine. All tether locations were reinforced and no more damage occurred during testing. Figure 4.6-2 shows the parafoil/tether damage and correction.

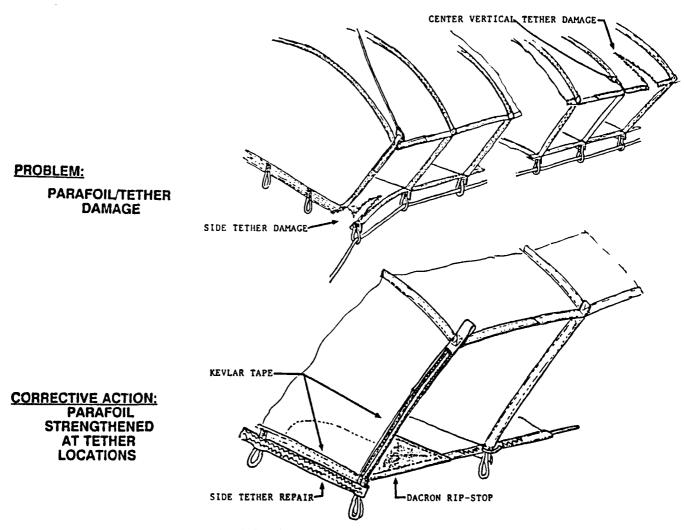


FIGURE 4.6-2, PARAFOIL/ TETHER DAMAGE AND CORRECTION

PROBLEM: Small Parafoil PACS Problem - The 10' x 30' parafoil could not generate enough lift to balance the PACS due to the short range of the PACS Xcp drive system.

CORRECTIVE ACTION: The front of the PACS was secured to the tunnel balance system to level the PACS. This allowed the small wing to be tested but the data could only be taken over a very small range due to the PACS not being able to move.

PROBLEM: Q Effects on Parafoil Angle of Attack - It was observed during testing that the angle of attack not only is a function of the rigging geometry but also is a function of the dynamic pressure (Q). Therefore, there was not an easy way to measure the angle of attack during testing. CORRECTIVE ACTION: The angle of attack was derived as a function of rigging geometry and dynamic pressure for data reduction and analysis purposes. The angle of attack was also measured and compared using video and still photographic techniques.

5.0 ANALYSIS OF RESULTS

The information in this section describes how the data was reduced after testing was completed.

5.1 ANGLE OF ATTACK SUMMARY

One of the basic differences between testing fabric wings and rigid structures is finding the wings angle of attack. With a rigid wing the angles can be measured directly by mounting sensors directly on the wing. Previous to this test it was thought that any instrumentation mounted in the wing would significantly change the shape of the wing, thus invalidating the test results. For this reason a inclinometer was not incorporated in the wing.

The angle of attack was derived as a function of the physical constants of the PACS and parafoil and of the variables measured during testing. The physical constants were the PACS plate hole geometry, parafoil suspension line geometry and parafoil chord length. The measured variables included; dynamic pressure (Q), angle between PACS top and bottom plates (δp), angle measured between front center suspension line and top plate (ϕj) and angle of the top plate relative to horizontal (αp).

A data base was compiled that consisted of geometric variables and aerodynamic coefficients measured during testing and was used in conjunction with a computer program to calculate the angle of attack for each data point. Figure 5.1-1 shows the angle of attack as a function of δp and dynamic pressure.

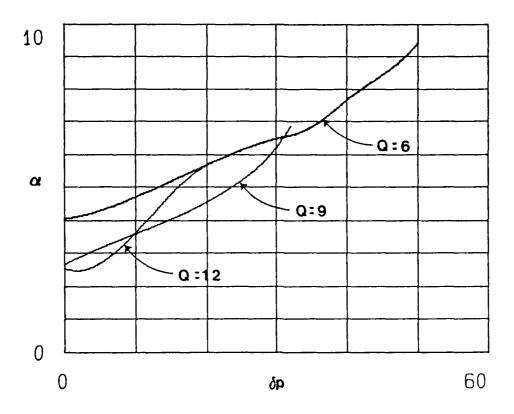


FIGURE 5.1-1, ANGLE OF ATTACK AS FUNCTION OF δ p AND DYNAMIC PRESSURE

The angle of attack was also measured using 70mm black and white and video photography. The method used was to place the cameras in the tunnel wall adjacent to where the wing would be flying. The wing tip was then photographed when each data point was taken. After testing was completed a grid was placed in the tunnel, in the same plane as the parafoil wing tip was flying, and photographed using the same two camera locations. The two films were superimposed and the angle of attack then directly measured (Figure 5.1-2).

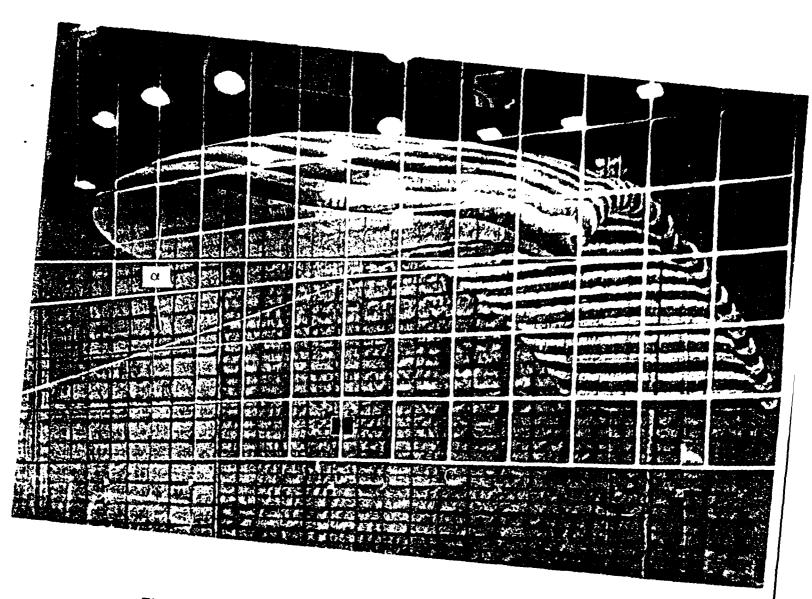
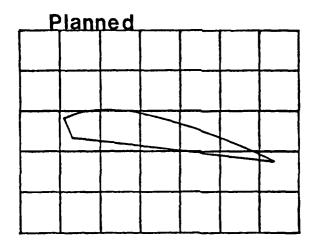


FIGURE 5.1-2, DIRECT MEASUREMENT OF ANGLE OF ATTACK

There were two problems with this method. The first problem was that the cameras had to be located in existing view ports that were located slightly aft and above the wing. The second problem encountered was that the wing distorted at high dynamic pressures. The distorted wing profile made it difficult to find the actual chord line of the parafoil therefore a average chordline was assumed.

Figure 5.1-3 shows planned versus actual angle measuring techniques. All of the measured values agree with calculated values to within 10%.



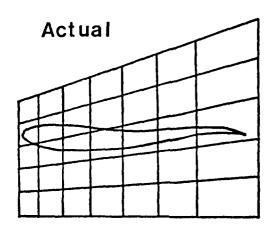


FIGURE 5.1-3, ANGLE OF ATTACK MEASURING TECHNIQUES PLANNED VS. ACTUAL

5.1.1 Angle of Attack Calculation

Figure 5.1-4 depicts the geometry used in determining parafoil angle of attack. Values for L₁, length of forward suspension line, and L₄, length of fourth suspension line, are constants to this configuration. The values for Cx, XX and Xf are also constant and are shown in the figure. The values of ϕ , δp , and αp , R, Ru, F, Fu, a, q₁ and q₂ vary for each set of test conditions.

To determine parafoil angle of attack the following set of equations are used:

$$\alpha = \alpha p - \phi + (180 - \theta_1 - \theta_2)$$

where:

$$\theta_1 = \cos^{-1} ((Fu^2 + a^2 - XX^2)/(2 Fu a))$$

$$\theta_2 = \cos^{-1} ((Cx^2 + a^2 - Ru^2)/(2 Cx a))$$

$$a = (Fu^2 + XX^2 - 2 Fu XX \cos \phi)^{1/2}$$

To determine Fu and Ru the following is used:

$$Fu = L_1 - F$$

$$Ru = L_4 - R$$

Where:

$$L_1 = L_R(1) - L_p(1) + L_{DP}(1)$$

 $L_4 = L_R(4) - L_p(4) + L_{DP}(4)$

Where LR is the line length from the parafoil to the confluence point, LP the length from the confluence point to the top plate and LDP the length from the bottom plate to the top plate. From analysis conducted in Section 5.3:

$$L_R(1) = 59.405 \text{ ft}$$
 $L_R(4) = 60.268 \text{ ft}$ $L_D(1) = 11.880 \text{ ft}$ $L_D(4) = 12.020 \text{ ft}$

To determine Lpp:

LDP =
$$(.3403 + 2(.3942 + x)^2 - 2(.3942 + x)(.3403 + (.3942 + x)^2)^{1/2} \cos(5 + \tan^{-1}(.5833/(.3942 + x))))^{1/2} + .0833$$

Where X is the longitudinal distance of the PACS hole location for the specific line. For line 1, X = 0.0 ft; for line 4, X = 0.5869 ft. Therefore.

$$L_{DP}(1) = 0.701 \text{ ft}$$
 $L_{DP}(4) = 0.752 \text{ ft}$

and the following are the resulting line lengths:

$$L_1 = 48.2 \, \text{ft}$$
 $L_4 = 49.0 \, \text{ft}$

The quantities L and R are functions of δp , the plate separation angle:

$$F(\delta p) = (.3403 + 2(.3942)^{2} - 2(.3942)(.3403 + (.3942)^{2})^{1/2}$$

$$\cos ((\delta p + 5) + \tan^{-1}(.5833/.3942)))^{1/2} + .0833$$

$$R(\delta p) = (.3403 + 2(0.9838)^2 - 2(0.9838)(.3403 + (0.9838)^2)^{1/2} \cos((\delta p + 5) + \tan^{-1}(.5838/0.938)))^{1/2} + .0833$$

Table 5.1-5 shows the quantities R, Ru, F, Fu as a function of δp.

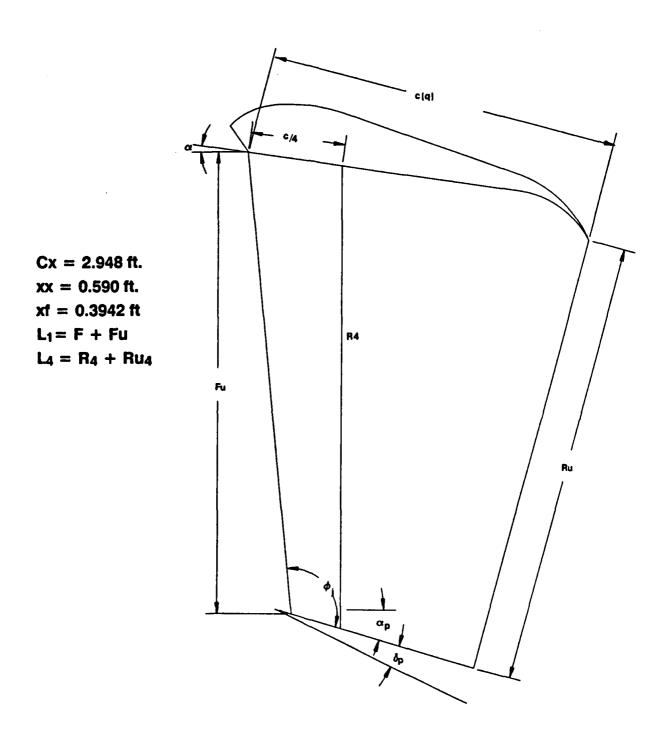


FIGURE 5.1-4, ANGLE OF ATTACK GEOMETRY

δρ	R	RU	F	FU
0.0000	0.7524	48.4476	0.7010	47.9990
5.0000	0.8376	48.3624	0.7351	47.9649
10.0000	0.9219	48.2781	0.7688	47.9312
15.0000	1.0050	48.1950	0.8019	47.8981
20.0000	1.0866	48.1134	0.8341	47.8659
25.0000	1.1666	48.0334	0.8655	47.8345
30.0000	1.2446	47.9554	0.8959	47.8041
35.0000	1.3206	47.8794	0.9251	47.7749
40.0000	1.3944	47.8056	0.9531	47.7469
45.0000	1.4657	47.7343	0.9797	47.7203
50.0000	1.5345	47.6655	1.0050	47.6950
55.0000	1.6006	47.5994	1.0288	47.6712
60.0000	1.6639	47.5361	1.0511	47.6489
65.0000	1.7242	47.4758	1.0717	47.6283
70.0000	1.7815	47,4185	1.0907	47.6093
75.0000	1.8355	47.3645	1.1080	47.5920
80.0000	1.8863	47.3137	1.1236	47.5764
85.0000	1.9337	47.2663	1.1373	47.5627

TABLE 5.1-5, LINE LENGTH FUNCTIONS

5.1.3 Angle of Attack Results

Table 5.1-6 shows the resulting parafoil angles of attack for wind tunnel runs 1-17, along with values discussed in Section 5.1.2.

R	P	ALPHAP	DELTAP	FU	RU	xx	A	сх	THETAL	THETA2	ALPHA	PHI
1	3	2.31	29.75	47.81	47.96	0.59	47.75	2.95	0.70	92.29	4.99	84.33
ī	4	-2.54	45.02	47.72	47.73	0.59	47.62	2.95	0.70	90.43	6.39	79.94
3	3	2.38	1.10	47.99	48.43	0.59	47.88	2.95	0.69	99.04	4.09	78.56
3	4	3.18	20.00	47.87	48.11	0.59	47.79	2.95	0.70	94.61	5.98	81.91
3	5	2.39	29.98	47.80	47.98	0.59	47.72	2.95	0.70	92.81	7.40	81.48
4	3	2.35	30.02	47.80	47.98	0.59	47.73	2.95	0.70	92.59	6.49	82.57
4	4	1.37	35.05	47.77	47.88	Ø.59	47.70	2.95	0.70	91.77	6.85	82.05
4	5	0.45	40.04	47.75	47.81	0.59	47.68	2.95	0.70	91.10	7.89	80.96
4	6	0.20	45.03	47.72	47.73	0.59	47.63	2.95	0.70	90.26	8.44	80.80
4	7	-0.50	50.03	47.69	47.87	0.59	47.59	2.95	0.70	89.62	9.42	79.76
5	3	-2.43	50.00	47.89	47.67	0.59	47.58	2.95	0.70	89.89	8.59	78.40
5	4	0.32	1.16	47.99	48.43	0.59	47.87	2.95	0.69	99.11	2.35	78.17
5	5	-2.48	12.30	47.92	48.24	0.59	47.78	2.95	Ø.69	97.23	3.29	76.34
6	3	-1.25	30.05	47.80	47.95	0.59	47.71	2.95	0.70	93.Ø1	4.61	80.43
6	4	-4.19	30.03	47.80	47.95	0.59	47.87	2.95	0.69	93.71	4.52	76.89
6	5	-5.35	29.93	47.80	47.96	0.59	47.88	2.95	0.69	93.95	4.23	75.78
6	6	-5.43	29.84	47.81	47.96	0.59	47.66	2.95	Ø.69	94.08	4.54	75.28
6	7	-5.50	29.81	47.81	47.96	0.59	47.65	2.95	0.68	94.16	4.85	74.80
6	8	-5.54	29.78	47.81	47.96	0.59	47.84	2.95	0.68	94.52	6.29	72.97
9	3	0.73	1.10	47.99	48.43	0.59	47.87	2.95	0.89	99.13	2.79	78.12
9	4	-1.20	19.72	47.87	48.12	0.59	47.75	2.95	0.89	95.41	4.53	78.17
9	5	-1.15	25.01	47.83	48.03	0.59	47.72	2.95	0.69	94.31	5.22	78.62
9	5	-0.75	30.03	47.80	47.95	0.59	47.78	2.95	0.89	93.29	6.23	79.04
9	7	-0.23	31.79	47.79	47.93	0.59	47.69	2.95	0.70	92.90	6.80	79.37
9	8	0.27	25.01	47.83	48.03	0.59	47.74	2.95	0.70	94.84	5.53	80.01
9	9	-3.53	25.01	47.83	48.03	0.59	47.70	2.95	0.89	94.80	4.84	78.14
9	10	-5.44	24.86	47.84	48.04	0.59	47.68	2.95	Ø.88	95.23	4.56	74.09
9	11	-5.58	24.69	47.84	48.04	0.59	47.68	2.95	Ø.68	95.30	4.57	73.89
9	12	-5.66	24.57	47.84	48.04	0.59	47.87	2.95	0.68	95.43	4.88	73.35
9	13	-5.76	24.25	47.84	48.05	0.59	47.67	2.95	Ø.68	95.85	5.39	72.52
10	3	1.09	19.95	47.87	48.11	0.59	47.77	2.95	0.78	94.92	5.04	80.44
10	4	-2.24	19.94	47.87	48.11	Ø.59	47.74	2.95	0.69	95.52	4.16	77.39
10	5	-5.43	19.81	47.87	48.12	0.59	47.71	2.95	0.88	96.23	3.75	73.91
10	6	-6.58	19.69	47.87	48.12	0.59	47.71	2.95	Ø.68	96.29	3.71	73.74
10	7	-5.69	19.58	47.87	48.12	Ø.59	47.70	2.95	0.68	96.36	3.80	73.47
10	8	-5.78	19.51	47.87	48.12	0.59	47.70	2.95	0.88	96.56	4.48	72.52
11	3	Ø.87	19.79	47.87	48.12	Ø.59	47.78	2.95	0.70	94.82	4.27	81.08
11	4	1.44	24.84	47.84	48.04	Ø.59	47.75	2.95	0.70	93.81	5.62	81.31
11	5	-2.57	27.12	47.82	48.60	0.59	47.60	2.95	0.88	95.99	12.88	67.98
11	6	0.92	29.79	47.81	47.98	6.59	47.73	2.95	0.70	92.78	5.59	81.85
11	7	0.01	29.78	47.81	47.96	0.59	47.72	2.95	0.70	92.96	5.44	80.91
11	8	0.52	29.77	47.81	47.96	0.59	47.72	2.95	0.70	92.93	5.78	81.11
11	. 9	-3.14	29.83	47.81	47.96	Ø.59	47.68	2.95	0.69	93.71	5.19	77.27
11	10	0.29	29.84	47.81	47.96	0.59	47.72	2.95 2.95	0.70	92.96	5.58 4.87	81.05
11	11	-4.87	29.45	47.81	47.96	0.59	47.66		Ø.69	94.10		75.48
	12	8.12 -5.44	29.54 29.22	47.81 47.81	47.96 47.97	Ø.59 Ø.59	47.72 47.66	2.95 2.95	0.79 0.68	92.97 94.3 0	5.34 4.93	81.11 74.64
11	13			47.81		Ø.59	47.72	2.95	Ø.76	92.99	5.43	81.17
11 12	14	Ø.29 1.44	29.34 29.99	47.80	47.97 47.96	Ø.59	47.74	2.95	8.78	92.52	5.28	82.93
	4	-0.39	29.99	47.80	47.96	0.59	47.72	2.95	0.70	92.96	4.98	81.03
12 12		Ø.35	29.99	47.80	47.96	Ø.59	47.72	2.95	0.70	92.75	5.13	81.76
12		-3.72	30.05	47.80	47.95	Ø.59	47.68	2.95	0.69	93.67	4.84	77.08
12		0.24	30.06	47.80	47.95	Ø.59	47.72	2.95	0.70	92.79	5.24	81.51
12		-5.27	30.22	47.86	47.95	0.59	47.66	2.95	0.69	93.90	4.48	75.74
12		Ø.35	30.22	47.80	47.95	0.59	47.72	2.95	0.70	92.74	5.27	81.84
	10	-5.44	30.42	47.80	47.95	8.59	47.65	2.95	83.0	93.99	4.79	75.09
	11	2.01	19.93	47.87	48.11	0.59	47.79	2.95	0.70	94.59	4.62	82.16
	12	0.98	19.93	47.87	48.11	0.59	47.78	2.95	0.70	94.78	4.35	81.15
	13	1.55	19.96	47.87	48.11	6.59	47.78	2.95	6.70	94.69	4.54	81.62
								_				

TABLE 5.1-6, ANGLE OF ATTACK RESULTS

R P	ALPHAP	DELTAP	FU	RU	XX	A	cx	THETA1	THETA2	ALPHA	PHI
12 14	6 .87	19.93	47.87	48.11	Ø.59	47.78	2.95	9.79	94.78	4.27	81.12
12 15	1.61	19.95	47.87	48.11	0.59	47.79	2.95	0.70	94.62	4.38	81.91
12 16	-2.57	19.53	47.87	48.12	0.59	47.74	2.95	0.69	95.59	3.70	77.45
12 17	1.44	19.59	47.87	48.12	0.59	47.79	2.95	Ø.7Ø	94.75	4.39	81.60
12 18	-3.49	20.03	47.87	48.11	0.59	47.73	2.95	0.69	95.66	3.58	76.60
12 19	1.73	20.08	47.87	48.11	Ø.59	47.79	2.95	0.70	94.61	4.58	81.84
12 20	-4.87	19.37	47.87	48.12	0.59	47.72	2.95	0.68	96.09	3.29	75.08
12 21	1.55	19.30	47.87	48.12	Ø.\$9	47.79	2.95	0.70	94.82	4.47	81.57
12 22	5.29	20.29	47.88	48.11	0.59	47.71	2.95	0.68	95.97	13.88	74.78
12 23	1.67	20.32	47.86	48.11	0.59	47.78	2.95	0.70	94.62	4.79	81.56
12 24	-5.50	19.21	47.87	48.13	Ø.59	47.71	2.95	0.88	96.31	3.41	74.10
12 25	1.44	19.35	47.87	48.12	0.59	47.79	2.95	Ø.7Ø	94.84	4.51	81.39
12 26	-5.44	20.41	47.86	48.11	0.59	47.71	2.95	0.68	98.03	3.48	74.37
12 27	-2.88	1.07	47.99	48.43	0.59	47.84	2.95	0.68	99.84	2.02	74.60
12 28	-4.18	1.07	47.99	48.43	0.59	47.83	2.95	_	100.10	1.77	73.28
12 29	-5.44	1.00	47.99	48.43	0.59	47.82	2.95		100.30	1.28	72.30
12 30	-5.50	0.89	47.99	48.43	0.59	47.82	2.95		100.27	0.98	72.60
12 31	-5.82	Ø.84	47.99	48.43	0.59	47.82	2.95		100.25	0.70	72.76
12 32	-3.32	0.95	47.99	48.43	0.59	47.84	2.95	0.68	99.88	1.60	74.52
12 33	-3.32	Ø.96	47.99	48.43	0.59	47.84	2.95	Ø.68	99.91	1.76	74.33
12 34 12 35	-3.89	Ø.96	47.99	48.43	0.59	47.83	2.95		100.07	1.83	73.53
12 36	-3.32	Ø.95 Ø.95	47.99 47.99	48.43	0.59	47.84	2.95	0.68	99.93	1.81	74.26
12 37	-3.89 -3.32	Ø.95	47.99	48.43	Ø.59	47.83	2.95		100.08	1.86	73.49
12 37	-5.44	Ø.93	47.99	48.43 48.43	Ø.59 Ø.59	47.84 47.82	2.95	0.68	99.92	1.78	74.30
12 39	-3.55	Ø.93	47.99	48.43	0.59	47.84	2.95 2.95		100.32	1.28	72.28
12 40	-5.33	0.94	47.99	48.43	0.59	47.81	2.95	Ø.68	99.96	1.63	74.19
12 41	-3.15	Ø.95	47.99	48.43	Ø.59	47.84	2.95	Ø.68	100.36 99.92	1.55	72.09
12 42	-5.44	0.77	47.99	48.43	0.59	47.82	2.95		100.33	1.98	74.29
12 43	-3.72	Ø.79	47.99	48.43	Ø.59	47.84	2.95	Ø.68	99.96	1.13 1.39	72.43 74.25
12 44	-5.44	1.00	47.99	48.43	Ø.59	47.81	2.95		100.37	1.53	71.99
12 45	-3.43	1.94	47.99	48.43	Ø.59	47.83	2.95	Ø.68	99.95	1.90	74.04
12 46	-5.44	0.48	48.00	48.44	Ø.59	47.82	2.95		100.42	1.17	72.30
12 47	-3.37	0.53	48.00	48.44	Ø.59	47.84	2.95		100.03	1.75	74.17
12 48	-5.44	1.18	47.99	48.43	0.59	47.81	2.95		100.31	1.48	72.10
12 49	-4.87	1.06	47.99	48.43	0.59	47.82	2.95		100.25	1.69	72.51
12 50	-3.55	1.07	47.99	48.43	0.59	47.83	2.95	0.68	99.98	1.91	73.88
13 3	1.61	29.99	47.80	47.98	0.59	47.73	2.95	0.70	92.69	6.14	82.08
13 4	1.61	29.99	47.80	47.96	8.59	47.73	2.95	0.70	92.69	6.11	82.11
13 5	1.61	30.00	47.80	47.96	0.59	47.73	2.95	0.70	92.68	6.08	82.15
13 6	1.61	29.99	47.80	47.98	Ø.59	47.73	2.95	6.78	92.71	6.22	81.97
13 7	1.50	29.99	47.80	47.96	0.59	47.72	2.95	0.70	92.75	6.26	81.79
13 8	1.44	29.99	47.80	47.98	0.59	47.72	2.95	0.70	92.81	6.43	81.50
13 9	1.44	29.99	47.80	47.96	0.59	47.72	2.95	0.70	92.89	6.74	81.11
13 10	1.84	30.00	47.80	47.96	0.59	47.71	2.95	0.70	93.03	6.92	86.39
13 11	0.28	29.98	47.80	47.98	0.59	47.89	2.95	0.89	93.38	7.59	78.61
13 12		29.99	47.80	47.98	0.59	47.86	2.95	0.89	93.95	11.83	75.73
13 13	2.38	30.00	47.80	47.96	Ø.59	47.73	2.95	0.70	92.55	6.27	82.78
13 14	2.59	30.00	47.80	47.98	0.59	47.74	2.95	0.70	92.51	6.40	82.98
13 15		29.98	47.80	47.96	0.59	47.73	2.95	0.70	92.55	6.52	82.82
13 16		29.98	47.80	47.98	Ø.59	47.73	2.95	0.70	92.57	6.63	82.69
13 17		30.00	47.86	47.96	Ø.59	47.73	2.95	0.70	92.58	6.31	82.65
13 18		30.00	47.80	47.96	Ø.59	47.73	2.95	0.76	92.69	6.54	82.08
13 19		3 <i>0.00</i> 29.98	47.80	47.96 47.96	Ø.59	47.72	2.95	0.70	92.77	6.45	81.69
13 2Ø 13 21		29.98	47.80 47.80	47.96	Ø.59 Ø.59	47.72 47.71	2.95 2.95	9.76	92.87	6.82	81.22
13 21		29.98	47.80	47.96	Ø.59	47.78	2.95	Ø.70 Ø.70	93.68	6.62	80.12
13 22		30.00	47.80	47.96	Ø.59	47.68	2.95	5.69	93.25 93.63	8.50	79.28
13 23		29.99	47.80	47.96	0.59	47.74	2.95	0.78	93.63 92.48	7.77 6.47	77.35 83.17
14 3		1.11	47.99	48.43	0.59	47.87	2.95	6.69	99.16	2.46	77.93
14 4		1.11	47.99	48.43	0.59	47.87	2.95	6.69	99.19	2.48	77.82
	7.20					• • •					

TABLE 5.1-6, ANGLE OF ATTACK RESULTS (CONTINUED)

R	P	ALPHAP	DELTAP	FU	RU	XX	A	сх	THETA1	THETA2	ALPHA	PHI
14	5	0.18	1.11	47.99	48.43	0.59	47.87	2.95	6.69	99.15	2.32	78.62
14	8	0.18	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.19	2.50	77.86
14	7	6.18	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.15	2.36	77.98
14	8	0.01	1.11	47.99	48.43	6.59	47.87	2.95	0.69	99.18	2.30	77.84
14	9	0.91	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.20	2.35	77.77
14	10	0.01	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.20	2.35	77.77
14	11	0.01	1.11	47.99	48.43	0.59	47.86	2.95	0.69	99.36	3.01	76.95
14	12	-1.14	1.11	47.99	48.43	0.59	47.85	2.95	6.68	99.54	2.50	76.03
14	13	0.01	1.11	47.99	48.43	0.59	47.84	2.95	0.58	99.70	4.36	75.27
14	14	0.52	1.11	47.99	48.43	Ø.59	47.87	2.95	0.69	99.11	2.53	78.19
14	15	Ø.52	1.12	47.99	48.43	0.59	47.88	2.95	0.69	99.08	2.43	78.32
14	16	Ø.52	1.11	47.99	48.43	0.59	47.87	2.95	Ø.89	99.12	2.56	78.15
14	17	0.52	1.11	47.99	48.43	0.59	47.87	2.95	0.89	99.11	2.54	78.18
14	18	0.52	1.11	47.99	48.43	Ø.59	47.87	2.95	6.69	99.12	2.55	78.16
14	19	0.52	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.19	2.82	77.82
14	20	0.52	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.17	2.78	77.88
14	21	0.01	1.11	47.99	48.43	0.59	47.87	2.95	0.69	99.21	2.42	77.69
14	22	-0.57	1.11	47.99	48.43	0.59	47.86	2.95	0.69	99.38	2.50	76.86
14	23	-0.85	1.11	47.99	48.43	0.59	47.85	2.95	0.68	99.54	2.89	76.03
14	24	-0.85	1.11	47.99	48.43	0.59	47.85	2.95	6.58	99.66	3.36	75.45
14	25	0.29	1.11	47.99	48.43	0.59	47.88	2.95	0.69	99.08	2.17	78.35
14	26	2.99	20.03	47.87	48.11	0.59	47.80	2.95	0.70	94.43	5.86	82.80
14	27	2.99	20.03	47.87	48.11	0.59	47.79	2.95	0.70	94.44	5.09	82.76
14	28	2.99	19.99	47.87	48.11	0.59	47.79	2.95	0.70	94.48	5.24	82.57
14	29	2.99	20.03	47.87	48.11	Ø.59	47.79	2.95	0.70	94.47	5.24	82.57
14	30	2.82	20.61	47.87	48.11	0.59	47.79	2.95	6.76	94.52	5.28	82.34
14	31	2.91	20.03	47.87	48.11	0.59	47.79	2.95	0.70	94.59	4.74	81.98
14	32	1.44	20.00	47.87	48.11	0.59	47.78	2.95	8.70	94.81	5.63	80.90
14	33	0.87	20.00	47.87	48.11	Ø.59	47.77	2.95	8.78	94.96	5.84	80.17
14	34	Ø.29	19.99	47.87	48.11	0.59	47.76	2.95	8.69	95.12	5.12	79.35
14	35	-0.85	19.99	47.87	48.11	0.59	47.74	2.95	0.69	95.48	5.35	77.65
14	36	-1.71	20.01	47.87	48.11	0.59	47.72	2.95	6.68	95.93	6.40	75.28
14	37	3.39	20.01	47.87	48.11	Ø.59	47.80	2.95	0.70	94.40	5.31	82.98
14	38	0.01	1.11	47.99	48.43	Ø.59	47.87	2.95	6.69	99.23	2.49	77.68
14	39	1.15	9.93	47.93	48.28	0.59	47.83	2.95	6.89	97.00	3.62	79.84
14	46	1.19	15.09	47.90	48.19	0.59	47.79	2.95	0.70	96.84	4.82	79.55
14	41	-2.28	19.91	47.87	48.11	6.59	47.72	2.95	8.69	95.91	5.87	75.46

TABLE 5.1-6, ANGLE OF ATTACK RESULTS (CONTINUED)

5.2 PACS WEIGHT TARE

The Parafoil Attitude Control System (PACS) was originally conceived to enable a parafoil to be tested through a range of rigging angles and to allow the parafoil to find its natural trim point. This concept consisted of a set of hinged plates to effect the change in rigging angle and a moveable pivot point (Xcp drive system) to allow the parafoil to fly at its natural trim angle without distorting the suspension system. The original design concept included an active counterweight system which would balance the PACS in both the X- and Z-axes thus keeping the center of gravity of the PACS at the pivot point no matter what the angle between the plates of the Xcp setting. This balanced system would reduce the effect of the PACS on the test article to only the dynamic moment of inertia of the system.

Due to time and budget constraints, the active counterweight system was replaced by a static counterweight. This static counterweight essentially only balanced the PACS in the X-axis at one angle between the plates and one Xcp setting. Because of this imbalance in the PACS, the test article was required to overcome the moment imposed about the pivot point by the weight of the PACS. This meant that the Xcp setting had to be increased to allow the parafoil normal force to overcome the increase in moment. During testing it was found that the travel of the Xcp drive system was insufficient to overcome this moment; thus the Xcp of the PACS could not be matched to the natural trim condition of the test article.

As a result of the imbalance of the PACS and the limited Xcp travel the data were compromised in two ways: (1) since the PACS could not match the natural trim condition of the test article, the parafoil suspension lines were slightly distorting the parafoil; and (2) the data included the moment created by the shift in the center of gravity (c.g.) of the PACS. The distortion of the parafoil was found to be minimal and could be considered within the accuracy of the rigging of the parafoil; however, the moment created by the PACS c.g. was found to be significant and required development of a methodology to modify the data to eliminate

the effect of the PACS c.g. shift. This section documents the methodology which was developed to calculate the weight tare of the PACS.

5.2.1 Weight Tare Methodology

Since the weight of the PACS with no tunnel flow always acts in the vertical plane in line with the pivot point, it is possible to determine the weight centroid of the PACS at a given angle between the plates. This is done by setting the PACS at the positive and negative Xcp limits and measuring the angle of the top plate with respect to horizontal at each of the Xcp settings. Given this information for a range of angles between the plates (δ_P) a set of calibration curves for the weight centroid can be developed as a function of δ_P . Figure 5.2-1 below defines the nomenclature necessary to develop the equations to calculate the weight centroid.

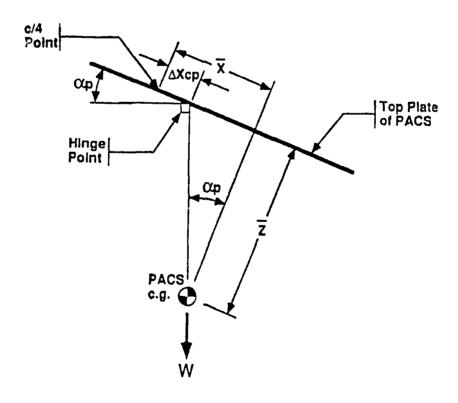


FIGURE 5.2-1, WEIGHT TARE NOMENCLATURE

The angle of the top plate (αp) is defined by the following equation.

$$\alpha p = tan^{-1}((x-\Delta X cp)/z)$$

For two ΔX cp locations the equation above can be transformed to the two equations below.

z tan
$$\alpha p_1 = x - \Delta X c p_1$$

z tan $\alpha p_2 = x - \Delta X c p_2$

Subtracting these equations and solving for the Z-axis centroid location yields the following equation.

$$z = (\Delta X cp_2 - \Delta X cp_1)/(\tan \alpha p_1 - \tan \alpha p_2)$$

Substituting the above equation into the original equation yields the following equation for the X-axis centroid location.

$$x = ((\Delta X cp_2 - \Delta X cp_1)/(\tan \alpha p_1 - \tan \alpha p_2)) \tan \alpha p_1 + \Delta X cp_1$$

This weight tare calibration was performed post-test at discrete values for the angle between the PACS plate ($\delta_p = 1^o$, 5^o , 10^o ,..., 50^o , 55^o , 59^o). These data were used to develop the weight tare calibration.

5.2.2 Inclinometer Calibration

When the weight tare calibration was performed it was discovered that the angle of the top plate exceeded the calibration range of the inclinometer used to measure the angle. A calibration of the inclinometer was performed to extend the calibrated range of the inclinometer. It was originally felt that this calibration might be questionable and outside the linear range of the inclinometer; however when the measured data were compared to the original calibration as shown below, the data showed a very good correlation.

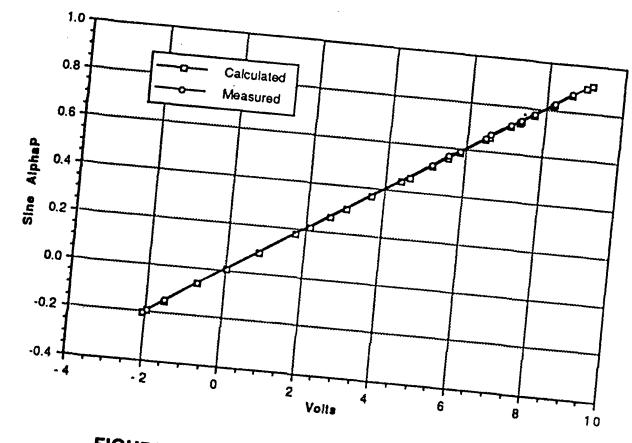


FIGURE 5.2-2, INCLINOMETER CALIBRATION

5.2.3 Weight Tare Calibration

Table 5.2-3 and Figure 5.2-4 were developed using the equations developed in the weight tare methodology section, the data obtained in the weight tare calibration, and the original inclinometer calibration. Due to the small plate angle changes with changes in Xcp at $\delta_p = 1^o$ and 5^o , the trigonometric tangent function accuracy cause these data to be questionable, therefore they were removed from the data base.

Point #	Lpot	DelP	Хср	Output	Calc Sine	Calc	Zbar	Xbar
	(In)	(deg)	<u>(In)</u>	(ellov)		AlphaP		
1			-2.500	2.118	0.2118	12.2259		
2	0.027	1	-2.505	7.373	0.7375	47.5194	-19.8377	-24.1688
3	0.027	1	3.932	8.167	0.8169	54.7799	ìi	
5	0.211	5	-2.501	9.142	0.9145	66.1330	5.4176	9.7435
4	0.211	5	3.933	7.312	0.7314	47.0042	4.6507	8.0103
28	0.211	5	3.938	6.586	0.6588	41.2061		
6	0.507	10	-2.501	9.025	0.9028	64.5261	4.5154	6.9768
27	0.507	10	3.938	5.582	0.5583	33.9400	}	
7	0.871	15	-2.501	8.655	0.8658	59.9701	5.3189	6.7004
26	0.871	15	3.939	4.607	0.4608	27.4374	i i	
8	1.296	20	-2.501	8.200	0.8202	55.1092	6.1812	6.3626
25	1.296	20	3.939	3.650	0.3650	21.4098		
9	1.775	25	-2.501	7.683	0.7685	50.2212	6.9533	5.8509
24	1.775	25	3.940	2.650	0.2650	15.3664	l	
10	2.301	30	-2.501	7.100	0.7102	45.2507	7.7676	5.3349
23	2.301	30	3.940	1.768	0.1767	10.1805	1	
11	2.866	35	-2.501	6.486	0.6488	40.4486	8.3721	4.6365
22	2.866	35	3.940	0.830	0.0829	4.7557		
12	3.463	40	-2.501	5.845	0.5846	35.7773	8.9790	3.9695
21	3.463	40	3.941	0.033	0.0032	0.1817		
13	4.085	45	-2.501	5.151	0.5152	31.0111	9.6171	3.2801
20	4.085	4.5	3.941	-0.684	-0.0686	-3.9314	i	
14	4.727	50	-2.501	4.397	0.4398	26.0892	10.0489	2.4195
19	4.727	50	3.941	-1.495	-0.1497	-8.6095		
15	5.378	5.5	-2.501	3.659	0.3659	21.4652	10.9141	1.7905
18	5.378	55	3.941	-1.931	-0.1933	-11.1465	1	
16	5.905	59	-2.501	3.030	0.3030	17.6383	12.2237	1.3856
17	5.905	59	3.937	-2.041	-0.2043	-11.7899	<u> </u>	_

TABLE 5.2-3, PACS CENTER OF GRAVITY CALCULATIONS

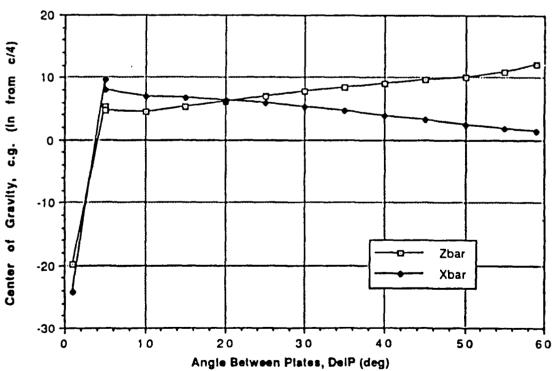


FIGURE 5.2-4, PACS CENTER OF GRAVITY LOCATION

5.2.4 Induced Moment

As mentioned earlier when the test article is "flying" it must overcome the moment induced by the offset in the PACS center of gravity. Figure 5.2-5 below depicts the nomenclature which defines this phenomenon.

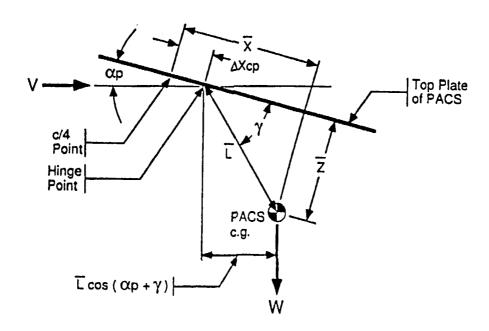


FIGURE 5.2-5, INDUCED MOMENT NOMENCLATURE

The distance from the pivot point to the PACS c.g. is given by the following equation.

$$L = ((x - \Delta X cp)^2 + (z)^2)^{1/2}$$

The angle between the top plate of the PACS, the pivot point, and the PACS c.g. is determined by the following equation.

$$\gamma = \tan^{-1}(z/(x-\Delta X cp))$$

The induced moment is therefore determined by the following equation.

$$\Delta MPACS(c.g.) = WPACSL sin(\alpha_p + \gamma)$$

This methodology was applied to all the data and the induced moment, due to the offset in the PACS c.g., was removed from the data.

5.3 SUSPENSION LINE LIFT AND DRAG STUDY

A study was conducted to determine the percentage of vehicle lift and drag due to the suspension lines. Originally a value of 15% was quoted for the line drag value, which is normal for an average parafoil setup. However, due to the number of lines found in the ARS Parafoil (960) a new study was conducted. To conduct this study the configuration and data were taken from the 20×60 ft parafoil tested at NASA Ames Research Center in August 1988.

5.3.1 Parafoil Configuration

The parafoil configuration, shown in Figure 5.3-1, is the 20 x 60 ft, 1/3 scale model. In estimating the line lift and drag, since the parafoil is laterally symmetrical, half the model was analyzed. (The final values were then doubled.) The test case chosen was at $\alpha = 0.0$, L/D = 2.90. Figure 5.3-2 shows the longitudinal line geometry at the test case.

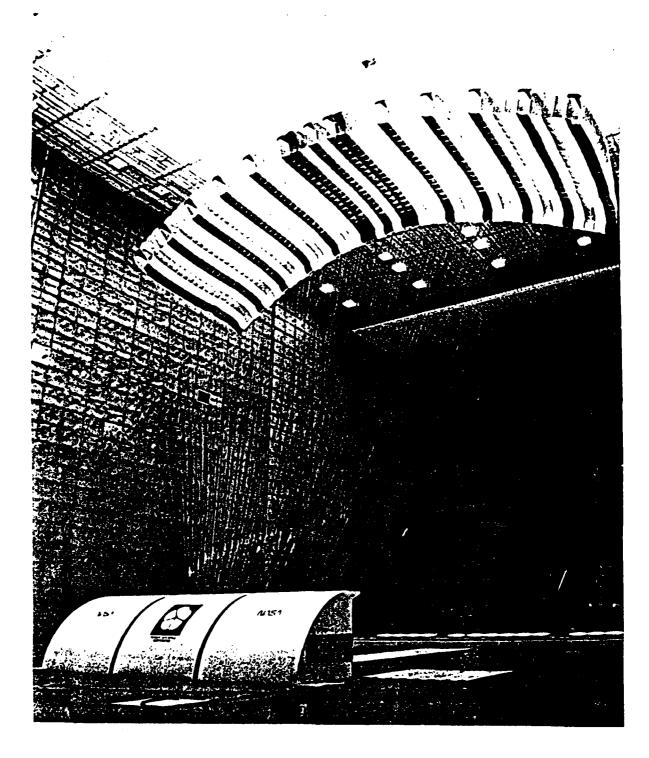


FIGURE 5.3-1, 20 FT X 60 FT PARAFOIL 1/3 SCALE MODEL

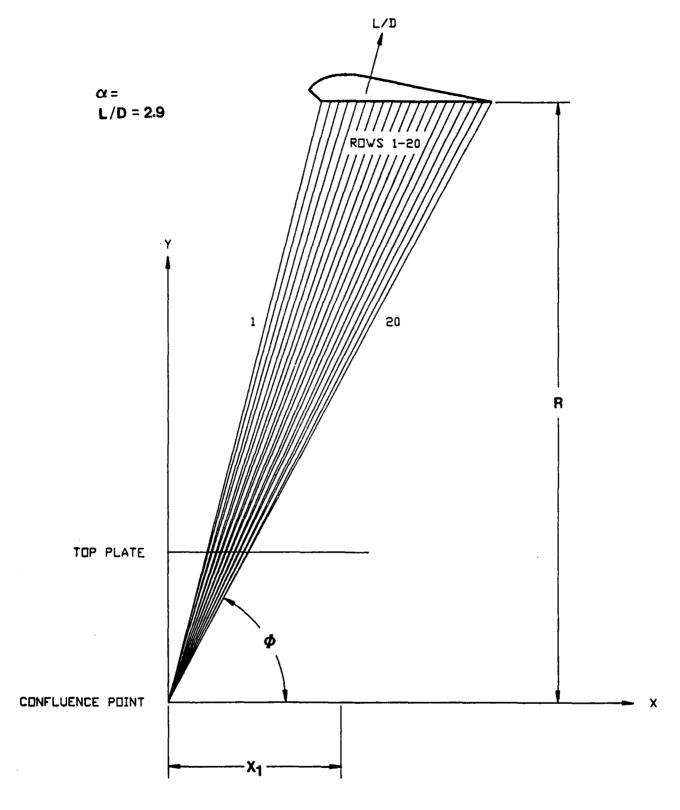


FIGURE 5.3-2, LONGITUDINAL LINE GEOMETRY

5.3.2 Drag Coefficient Estimate

1

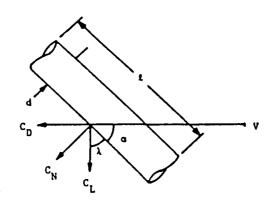
As a means of comparison to the wind tunnel test case, which lists aero coefficients, a C_D for the suspension lines had to be determined. In <u>Fluid Dynamic Drag</u> (Hoerner, 1965) the Cross Flow Principle is used, which determines coefficients for flow around wires and cables. Figure 5.3-3 depicts the nomenclature for the Cross Flow Principle. To determine C_D the following equations are used:

where CD1 is the Drag Coefficient based on each line's reference area, CD2 the Drag Coefficient based on the total line reference area (105.87 ft²), CD3 the Drag Coefficient based on the parafoil reference area (1200 ft²) and ϕ is the angle of attack. Table 5.3-7 lists the values calculated for the angle ϕ , and Table 5.3-8 the values for $A_{ref}1$.

In the equations above the line diameter, D, was assumed to be 4.458×10^{-3} ft, or the average diameter of the lines under load. In determining the length, L, only the line length exposed to the flow was used. The following equation was used to obtain this length.

$$LA = LR - LP$$

where LR is the length from the parafoil to the confluence point, LP the length from confluence point to the top plate, and LA the exposed length (see Figure 5.3-4). Tables 5.3-9 to 5.3-11 give values calculated for the line lengths, LA.



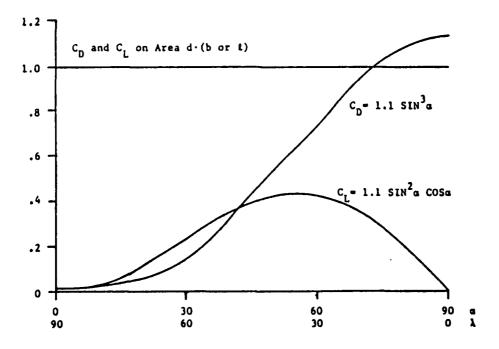


FIGURE 5.3-3, CROSS FLOW PRINCIPLE

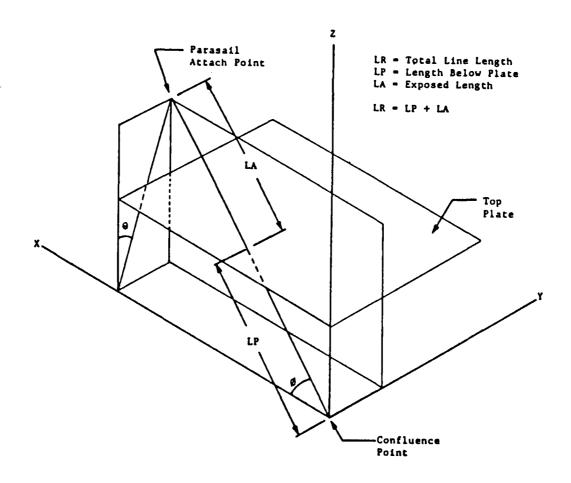


FIGURE 5.3-4, LINE LENGTH NOMENCLATURE

5.3.3 Drag Coefficient Results

Drag coefficients were calculated using equations derived in Section 5.3.2. The results for C_{D1}, C_{D2} and C_{D3} can be found in Tables 5.3-6, 5.3-7 and 5.3-8 respectively. The total C_D's for the lines were found to be the following:

 $C_{D2T} = 1.73709$ (based on $A_{ref}2$) $C_{D3T} = 0.15326$ (based on $A_{ref}3$)

5.3.4 Lift Coefficient Estimate

A C_L for the suspension lines also had to be determined for comparison purposes. The same Cross Flow principle found in <u>Fluid Dynamic Drag</u> (Hoerner 1965)² is used. Figure 5.3-3 depicts the nomenclature for the Cross Flow Principle, and Figure 5.3-5 depicts the geometry for determining C_L. The following set of equations are used in calculating C_L:

 $C_{L1} = 1.10 \sin^2(\phi) * \cos(\phi) * \cos(\theta)$ Aref = Aref1 $C_{L2} = C_{L1} * Aref1/Aref2$ Aref = Aref2 $C_{L3} = C_{L2} * Aref2/Aref3$ Aref = Aref3

where C_{L1} is the Lift Coefficient based on each line's reference area, C_{L2} with Lift Coefficient based on the total line reference area (105.87 ft²), C_{L3} the Lift Coefficient based on the parafoil reference area (1200 ft²), ϕ is the angle of attack, and θ is the rotation angle in the YZ plane. Table 5.3-1 lists the values calculated for the angle ϕ , Table 5.3-9 the values for angle θ , and Table 5.3-3 the values for $A_{ref}1$.

In the equations above the line diameter, D, was assumed to be 4.458×10^{-3} ft, or the average diameter of the lines under load. In determining the length, L, only exposed the line length discussed in Section 5.3.2 was used.

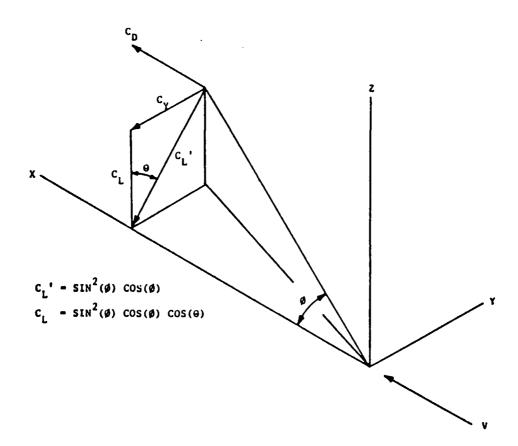


FIGURE 5.3-5, LIFT COEFFICIENT GEOMETRY

5.3.5 Lift Coefficient Results

Lift coefficients were calculated using equations developed in section 5.3.4. The results for C_{L1} , C_{L2} and C_{L3} can be found in Tables 5.3-10, 5.3-11 and 5.3-12 respectively.

The total C_L's for the lines were found to be the following:

 $C_{L2T} = -0.66988$ (based on Aref2)

CL3T = -0.05910 (based on Aref3)

NOTE: The negative sign reflects that the line lift acts in the opposite direction of parafoil lift.

5.3.6 Comparison to Test Data

To determine the percentage of drag due to the lines a test point from the wind tunnel was selected having a similar set of parafoil attitude conditions. Shown in Figure 5.3-6 is the selected point with an $\alpha p = 0.2$ and an L/D of 2.93. As the figure shows:

$$C_D = 0.315895$$

and for the lines:

$$C_{D3T} = 0.15236$$

Therefore:

$$C_D$$
 Lines = 48.5% of total drag

In determining the percentage of lift due to the lines, the same test condition shown in Figure 5.3-6 was used. As the figure shows:

$$C_L = 0.927782$$

and for the lines:

$$C_{L3T} = -0.05910$$

Therefore:

C_L Lines = 6.4% of total Lift (negative sense)

-		POINT	• ACQ	UIRED	POINT 6 ACQUIRED 9/12/88 AT 17:33: 1	AT 17	:33: 1		DATE PRINTED 18/13/88	10/13/88		RINTEL	TIME PRINTED 16:32:63		CONF	2.e	2.0 VEH 3
TUBEL	OTUMBEL CONDITIONS	1		!	; ; ;		* * * * * * * * * * * * * * * * * * *		PACS				8	CONTROL LINES CONTROL, C	INES	CONTROL, C	OL., C
PRESSURES	PRESSURES	TEMPE	TEMPERATURES		VELOCITIES	Ä	MISCELL ANEOUS	Æ0US	ANGLES		CENTER OF PRESSURE	PRESSL	Æ				
EARO	BAR0 14.664#	F	82.8	WKTS	42.61	Ī	68.7	-	ALPHAP	0.20	XCP	XCP 3.887			- 0.1	_	•
ĭ	0.0100	_		Š	MUN 8.8642	8HO	.233	.233847E-82	8 IHdr	93.61	DISTANCES	ACES	N		-1.1	~	-9 .5
r		_							PHI	96.96	LP07 21.666	21.666	5	כוויי	0.063		
•	6.8463	-							THETA	86.35			5	CTL2	0.082		
									DELTAP 46.03	46.03							
TETHE	TETHER LINES								TETHER, C	Ů.							
-	1 -0.2 2	9.6	•	•	•	-6.1				2	-0.1	-	•	~	• •		
RISERS	ø								RISERS,C	Ų							
1 21	21.3 6	18.4	•	43.7	2 .	32.1	32.0 17	18.4	7	9.0	3.6	٠	7.2 11	=	₹.9	11	•
~	22.1 0	9.98	9.	126.6	11	36.2	2 10	13.1	8	3.6 0	6.6	:	28.9 14	=	•.		2.2
•	27.2 7	13	11 87.8	47.9	316	23.8	20	11.6	~	4.6 7	₹.	::	7.9 16	91	9.0	9	1.0
•	1 .2	•	6.6 12	5.	43.0 10	16.4	16.9 20	6.1	•	6.7	1.1	12	7.1 16	92	2.6	30	:
ONT NO	PUTIND TUNNEL BALANCE LOADS	BALANCE	_	1300 OM	AND COEFFICEINTS MODEL	8	MODEL					i			,		
LIFT			TCHU	-613.	-813. LIFTC		6732.	PITCHC	-813.	٦/٥	2.937		CL 8.927782	6.927782	AND -	•	-0.00001
DRAGE		2292. YANU	3	-136.	DRAGC		2292.	YAWC	-130.	DETINCE	8236.58		1 CD 6.316895	0.316896	ZNO -		-6.000200
SIDEN		-166. RO	ROLLU	-617.	SIDEC		-166.	ROLLC	-617.				ر≺ -•	-0.021601		•	CMX -0.001107

FIGURE 5.3-6, WIND TUNNEL TEST CASE

		1	2	3	4	5	8	7	8	9	16
	1	76.26661	75.34832	74.43865	73.53695	72.64358	71.75879	76.88293	76.61626	69.15962	68.31144
	2	76.26561	75.34832	74.43865	73.53695	72.84358	71.75879	76.88293	76.61626	69.15962	68.31144
	3	76.26561	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	70.51626	69.15962	68.31144
•	4	76.26561	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	76.61626	89.15982	68.31744
No	5 8	76.26561 76.26561	75.34832 75.34832	74.43866 74.43865	73.53695 73.53695	72.84358 72.84358	71.75879 71.75879	75.88293 75.88293	76.61626	89.15962	68.31144
	7	76.26561	75.34832	74.43865	73.53695	72.64358	71.75879	76.88293	76.81626 76.61626	69.15962 69.15962	68.31144 68.31144
စ္	ė	76.26661	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	76.51626	69.15962	68.31144
Line	9	76.26561	75.34832	74.43865	73.53695	72.64358	71.75879	78.88293	70.01626	69.15962	68.31144
-	10	76.26561	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	76.61626	69.15962	68.31144
54	11	76.26561	75.34832	74.43865	73.53696	72.84356	71.75879	70.88293	76.61626	69.15962	68.31144
ser	12	76.26561	75.34832	74.43865	73.53696	72.64356	71.75879	76.88293	76.81626	69.15962	68.31144
• •	13 14	78.28581 76.28581	75.34832 75.34832	74.43865 74.43866	73.53696 73.53695	72.64356 72.64358	71.75879 71.75879	76.88293 76.88293	78.81626	69.15962	68.31144
α	15	76.26561	75.34832	74.43865	73.53695	72.84358	71.75879	76.88293	70.61626 70.61626	69.15962 69.15962	68.31144 68.31144
ø	16	76.28581	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	76.51626	69.15962	68.31144
.s	17	78.26561	75.34832	74.43865	73.53695	72.64356	71.75879	76.88293	76.61626	69.15962	68.31144
3	10	76.28581	75.34832	74.43865	73.53695	72.64356	71.75879	78.88293	78.81626	69.15962	68.31144
panwise	19	76.26561	75.34832	74.43865	73.53696	72.64356	71.75879	76.88293	78.81626	69.15962	68.31144
ď	26	76.26561	75.34832	74.43865	73.53696	72.64356	71.75879	76.88293	76.61626	69.15902	68.31144
S	21	76.26561	75.34832	74.43865	73.53696	72.64356	71.75879	76.88293	78.61626	69.15962	68.31144
	22 28	76.26561 76.26561	75.34832 75.34832	74.43865 74.43865	73.53695	72.84358	71.75879	76.88293	76.61626	69.15962	68.31144
	24	78.28561	75.34832	74.43866	73.53695 73.53695	72.84358 72.84358	71.75879 71.75879	76.88293 76.88293	70.01626 76.01626	69.15962 69.15962	68.31144 68.31144
		,0.20001	,0.54001	74.45000	73.50050	72.04000	,1.,00,0	70.50285	70.01020	09.10902	08.31144
		11	12	13	14	16	16	17	18	19	26
	1	67.47371	66.54662	65.82852	86.62137	64.22467	63.43852	62.66362	61.89822	61.14416	66.45689
	2	67.47371	66.84802	65.82852	85.02137	64.22467	63.43852	62.66362	61.89822	61.14416	68.48689
	3	67.47371	66.64662	65.82852	65.62137	64.22467	63.43852	62.66302	61.89822	81.14416	68.4 86 89
	4 6	67.47371 67.47371	66.646 <i>0</i> 2 66.646 <i>0</i> 2	65.82852 65.82852	65. 6 2137 65. 6 2137	64.22467 64.22467	63.43852	62.66362	61.89822	61.14416	66.46689
•	ä	67.47371	66.64662	65.82862	65.62137	64.22467	63.43852 63.43852	62.663 <i>8</i> 2 62.663 <i>8</i> 2	61.89822 61.89822	61.14416 61.14416	68.4 66 89 68.4 66 89
Š	7	67.47371	66.64662	65.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	66.40659
	•	67.47371	66.64662	65.82862	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	66.46689
Line	9	67.47371	66.646 6 2	65.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	68.46689
Ę	10	67.47371	66.54662	65.82852	65.#2137	64.22467	63.43852	62.66362	61.89822	61.14416	66.46619
	11	67.47371	66.64662	65.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	68 . 4 86 89
ser	12	67.47371	66.64662	65.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	60.40089
8	18 14	67.47371 67.47371	66.646 0 2 66.646 0 2	65.82852 65.82852	65. 8 2137 65. 8 2137	64.22467 64.22467	63.43852 63.43852	62.66362 52.66362	61.89822 61.89822	61.14416 61.14416	60.40009
E.	15	67.47371	66.64662	65.82852	65. 6 2137	64.22467	63.43852	62.66302	61.89822	61.14416	66 . 4 06 89 66 . 4 66 89
	16	67.47371	86.64882	65.82862	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	68.48689
panvise	17	67.47371	68.64662	66.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	66.46689
•=	18	67.47371	66.64662	65.82852	65.62137	64.22467	63.43852	62.66362	61.89822	61.14416	66.46619
2	19	67.47371	66.64602	85.82852	65.02137	64.22467	63.43852	62.66382	61.89822	61.14416	68.46689
8	29	67.47371	66.64662	65.82852	65.02137	64.22467	63.43852	62.66362	61.89822	61.14416	68.40089
Sp	21	67.47371	66.64662	65.82852	66.02137	64.22467	63.43852	62.66362	61.89822	61.14416	66.46689
63	22 23	67.47371 67.47371	66.64662	65.82852	65. 6 2137	64.22467 64.22467	63.43852	62.66362	61.89822	61.14416	66.46689
	24	67.47371	66.646 6 2 66.646 6 2	65.82852 65.82852	65. 0 2137 65. 0 2137	64.22467	63.43852 63.43852	62.663 6 2 62.663 6 2	61.89822 61.89822	61.14416 61.14416	66.4 66 89 66.4 66 891

TABLE 5.3-7, PHI (LONGITUDINAL LINE ANGLE), deg

		1	2	3	4	6	6	7	8	9	16
	1	6.21179	6.21262	6.21366	6.21444	6.21543	5 .21648	6.21757	S.21872	6.21991	6.22116
	2	6.21179	6.21262	6.21356	6.21444	6.21543	0.21648	Ø.21767	6.21872	6.21991	6.22116
	3	6.21179	6.21262	8.21358	6.21444	0.21543	8.21648	6.21757	6.21872	6.21991	6.22116
	4	6.21167	6.21256	6.21339	6.21432	Ø.21532	6.21636	8.21745	6.21866	6.21979	0.22184
•	6	Ø.21167	6.21256	6.21339	6.21432	Ø.21532	6.21636	6.21745	6.21866	6.21979	6.22164
8	6	6.21167	6.21256	6.21339	6.21432	Ø.21532	0.21636	8.21745	6.21866	6.21979	0.22104
	7	6.21134	8.21217	6.21366	6.21466	6.21499	6.21663	6.21712	6.21827	6.21946	6.22676
Line	8	0.21134	8.21217	6.21366	6.21466	6.21499	6.21663	6.21712	6.21827	6.21946	6.22676
ij	9	0.21134	6.21217	0.21366	6.21400	0.21499	6.21663	6.21712	6.21827	0.21946	0.22078
	16	6.21886	6.21163	0.21251	0.21346	6.21444	6.21548	6.21657	6.21771	6.21891	0.22015
u	11	6.21686	6.21163	6.21251	6.21346	8.21444	0.21548	6.21657	6.21771	6.21891	0.22015
er	12	6.21686	6.21163	6.21261	6.21345	6.21444	6.21548	6.21667	6.21771	5.21891	0.22016
is	13 14	0.21864 0.21864	6.21 <i>6</i> 86 6.21 <i>6</i> 86	0.21174	0.21268	6.21366	8.21476	6.21579	0.21693	6.21812	0.21936
æ	15	6.21 86 4	6.21886	6.21174 6.21174	6.21268 6.21268	Ø.21366 Ø.21366	6.21476 6.21476	6.21579	6.21693	6.21812	8.21936
	16	0.25963	6.25985	Ø.21173	6.21166	8.21265	6.21368	8.21579 8.21476	6.21693	6.21812	B.21936
9	17	0.28963	6.2 59 85	6.21873	5.21166 5.21166	8.21285	6.21368	8.21476	6.21596 6.21596	6.21768 6.21768	Ø.21832
·=	18	6.26963	6.26985	0.21073	6.21166	6.21265	6.21368	6.21476	6.21596	6.21788	8.21832 6.21832
panwise	19	0.25776	6.25868	6.25946	6.21638	6.21136	6.21239	0.21347	6.21466	Ø.21578	0.21761
8	29	6.28776	6.26868	6.28946	0.21038	6.21136	6.21239	6.21347	6.21466	6.21578	6.21761
þ	21	8.26776	6.28858	6.25946	0.21038	0.21136	0.21239	0.21347	8.21466	6.21578	6.21761
0,	22	6.26626	6.26762	6.26789	6.25881	6.26978	6.21681	6.21188	6.21361	6.21418	0.21546
	23	6.26626	6.28762	6.26789	6.26881	6.26978	6.21881	6.21188	0.21361	6.21418	0.21540
	24	6.25625	8.28782	6.26789	5.25881	6.26978	6.21681	5.21188	6.21361	6.21418	8.21546
		11	12	13	14	15	16	17	18	19	26
	1	6.22246	6.22379	6.22518	B.22661	6.22869	6.22961	6.23118	6.23279	6.23443	6.23612
	2	8.22245	0.22379	6.22518	6.22661	6.22869	8.22961	6.23118	6.23279	6.23443	0.23612
	3	6.22246	6.22379	6.22518	5 .22661	6.22869	Ø.22961	6.23118	6.23279	6.23443	Ø.23612
ċ	4	6.22233	6.22367	6.22586	6.22649	8.22797	6.22949	6.23165	6.23266	0.23431	Ø.236 66
N _o	5	6 .22233	6.22367	8.22588	6 .22649	6.22797	6.22949	8.23185	5 .23266	6.23431	23666
a	6	6.22233	0.22367	6.22566	0.22649	6.22797	6.22949	6.23165	6.23266	Ø.23431	6.23666
Line	7	6.22199	6.22333	6.22472	6.22615	6.22762	6.22914	6.23671	6.23231	6.23396	6.23564
•		Ø.22199	6.22333	6.22472	6.22615	8.22762	6.22914	0.23071	6.23231	0.23396	0.23584
	9	6.22199 6.22144	6 .22333 6 .22277	6.22472	6.22616	6.22762	6.22914	6.23671	6.23231	6.23396	6.23664
ser	16	6.22144	6.22277	6.22415 6.22415	6 .22558 6 .22558	6.22766 6.22766	6.22857 6.22857	6.23613 6.23613	6.23173	5 .23337	Ø.23566
Š	12	6.22144	6.22277	6.22415	6 .22558	6.22765	6.22857	6.23613	6.23173 6.23173	6.23337	6.235 66
***	13	6.22564	6.22197	6.22335	6.22478	6.22624	6.22776	6.22931	6.23691	6.23337 6.23254	. 0.23566 0.23422
œ	14	6.22664	6.22197	0.22335	6.22478	6.22624	6.22776	0.22931	6.23691	0.23254	6.23422
a	15	0.22864	6.22197	6.22335	6.22478	6.22624	Ø.22776	6.22931	6.23691	0.23254	6.23422
9	16	6.21966	6.22693	6.22236	6.22372	6.22518	6.22669	6.22823	6.22982	0.23145	6.23313
Spanwise	17	6.21966	6.22693	€.2223€	Ø.22372	Ø.22518	6.22669	Ø.22823	6.22982	Ø.23146	6.23313
Ξ	18	6.21966	6.22593	6.22236	6.22372	6.22518	6.22669	6.22823	6.22982	€.23146	6.23313
<u> </u>	19	6.21828	8.21968	6.22697	6.22238	6.22384	6.22534	6.22686	6.22926	6.23668	0.23174
S	29	6.21828	6.21966	6.22697	6 .22238	6.22384	6.22534	6.22688	6.22926	6.23668	6.23174
	21	6.21828	6.21966	6.22897	6.22238	6.22384	6.22534	0.22688	6.22926	6.23668	6.23174
	22	6.21667	6.21796	6.21934	8.22974	6.22219	€.22368	€ .22521	6.22678	6.22846	6.23065
	23	0.21667	6.21798	6.21934	6.22574	6.22219	6.22368	6.22521	6.22678	8.2284€	6.23665
	24	6.21667	6.21798	6 .21934	6.22874	6.22219	Ø.22368	6 .22521	Ø.22678	6.22846	6.23065

TABLE 5.3-8, AREF1 (LINE REFERENCE AREA), ft²

		1	2	3	4	5	6	7	8	9	10
	1	59.38813	59.62969	59.88526	66.15628	66.44212	68.74252	61.65725	61.38611	61.72886	62.08527
	2	69.38813	59.82969	59.88526	66.15628	66.44212	68.74252	61.65725	61.38611	61.72886	62.68527
	3	59.38813	59.62969	59.8852 6	66.15628	60.44212	60.74252	61.85725	61.38611	61.72886	62.88527
	4	69.38813	59.62969	59.88525	66.15628	66.44212	60.74252	61.05725	61.38611	61.72886	62.68527
No	5	59.38813	59.62969	59.88526	66.15628	66.44212	66.74252	61.05725	61.38611	61.72886	62.08527
Z	6	59.38813	59.629 69	59.8852 <i>6</i> 59.8852 <i>6</i>	66.15628 66.15628	68.44212 68.44212	66.74252 66.74252	61.05725 61.05725	61.38611 61.38611	61.72886 61.72886	62.68527 62.68527
ne	7 8	59.38813 59.38813	59.629 6 9 59.629 69	59.88526	60.15628	60.44212	60.74252	61.66725	61.38611	61.72886	62.68527
표	Š	59.38813	59.529 6 9	69.88526	60.15628	68.44212	60.74252	61.85725	61.38611	61.72886	62.68527
_	16	59.38813	69.62969	59.88525	66.15628	60.44212	60.74252	61.85725	61.38611	61.72886	62.08527
i.	11	59.38813	59.62969	59.88525	66.15628	68.44212	68.74252	61.65725	61.38611	61.72896	62.88527
a	12	59.38813	59.82 969	59.8852 \$	60.15628	60.44212	60.74252	61. <i>8</i> 5725	61.38611	61.72926	62.68527
i s	13	59.38813	59.62 969	59.88528	66.15628	68.44212	60.74252	61.05725	61.38611	61.72086	62.68527
24	14	59.38813	59.62969	59.88526	66.15828	66.44212	60.74252	61.85725	61.38611	61.72886	62.68627
a	15	69.38813	58.62969	59.88526	66.15628	66.44212	68.74252	61.65725	61.38611	61.72886	62.68527
C/D	16	59.38813	59.629 6 9	59.8852 6 59.8852 6	66.15628 66.15628	66.44212 66.44212	66.74252 66.74252	61. <i>6</i> 5725 61. <i>6</i> 5725	61.38611 61.38611	61.72886 61.72886	62.88527 62.88527
.2	17 18	59.38813 59.38813	59.629 69 59.629 6 9	59.88526	66.15628	66.44212	88.74252	61.65725	61.38611	61.72886	62.68527
panwi	19	59.38813	59.62969	59.88625	66.15628	66.44212	68.74252	61.05725	61.38611	61.72886	62.88527
8	20	59.38813	59.62969	59.88526	68.15628	68.44212	66.74252	61.05725	61.38611	61.72886	62.88627
\mathbf{S}	21	59.38813	59.82969	59.88520	68.15628	66.44212	66.74252	61.85725	61.38611	61.72886	62.88527
	22	59.38813	59.62969	59.8852 6	66.15628	66.44212	66.74252	61.05725	61.38611	61.72886	62.68627
	23	59.38813	59.62969	59.8852 6	60.15628	68.44212	66.74252	61.65725	61.38611	61.72886	62.08527
	24	59.38813	59.62 96 9	59.8852 6	66.15628	66.44212	66.74252	61.85725	61.38611	61.72886	62.68627
		11	12	13	14	15	16	17	18	19	29
	1	62.45511	62.83815	63.23414	63.64284	64.86481	64.49746	64.94277	65.39987	65.86847	66.34831
	2	62.46511	62.83815	63.23414	63.64284	64.86401	64.49746	64.94277	65.39987	65.86847	66.34831
	3	62.45511	62.83815	63.23414	63.64284	64.86461	64.49746	64.94277	65.39987	65.86847	66.34831
•	4	62.45511	62.83815	63.23414	63.64284 63.64284	64.86481 64.86481	64.4974 6 64.4974 6	64.94277 64.94277	65.39987 65.39987	65.86847 65.86847	66.34831 66.34831
8	5 6	62.45511 62.45511	62.83815 62.83815	63.23414 63.23414	63.64284	64.66461	64.49748	64.94277	65.39987	65.86847	66.34831
	7	62.45511	62.83815	63.23414	63.64284	64.86481	64.49746	64.94277	65.39987	65.86847	66.34831
Line	i	62.45511	62.83815	63.23414	63.64284	64.86401	64.49746	64.94277	65.39987	65.86847	66.34831
	9	62.45511	62.83815	63.23414	63.64284	64.86481	64.49746	64.94277	65.39987	65.86847	66.34831
-	16	62.45511	62.83815	63.23414	63.64284	64.66461	64.49746	64.94277	85.39987	65.86847	66.34831
M	11	62.45511	62.83815	63.23414	63.64284	64.66461	64.49746	64.94277	65.39987	65.86847	66.34831
Riser	12	62.46511	62.83815	63.23414	63.64284	64.66461	64.49746	64.94277	65.39987	65.86847	66.34831
.=	13	62.45511	62.83815	63.23414	63.64284	64.66461	84.49746	64.94277	65.39987	65.86847	66.34831
~	14	62.45511	82.83815	63.23414	63.64284	64.66461	64.49746	64.94277 64.94277	65.39987	65.86847	66.34831
v	15	62.45511	62.83815 62.83815	63.23414 63.23414	63.64284 63.64284	64. 6 64 6 1	64.49746 64.49746	64.94277	65.39987 65.39987	65.86847 65.86847	66.34831 66.34831
9	16 17	62.45511 62.45511	82.83815	63.23414	63.64284	64.56481	64.49746	64.94277	65.39987	65.86847	66.34831
Spanvise	18	62.46511	62.83815	63.23414	63.64284	64.56451	84.49746	64.94277	65.39987	65.86847	66.34831
Ĭ	19	62.46511	62.83815	63.23414	63.64284	64.66461	64.49746	64.94277	65.39987	65.86847	66.34831
Ž,	29	62.46511	62.83815	63.23414	63.64284	64.66461	64.49746	84.94277	65.39987	65.86847	66.34831
S	21	62.46511	62.83815	63.23414	63.64284	64.66461	64.49746	64.94277	66.39987	65.86847	66.34831
		AC 45511	40 03016	42 02414	42 44204	64.66461	64.49746	64.94277	65.39967	AF 88847	
	22	82.46511	62.83815	63.23414	63.64284	_			-	65.86847	66.34831
	22 23 24	62.45511 62.45511	62.83815 62.83815	63.23414 63.23414	63.64284 63.64284	64. 8 64 6 1 64. 8 64 6 1	64.4974 6 64.4974 6	64.94277 64.94277	65.39987 65.39987	65.86847 65.86847	66.34831 66.34831

TABLE 5.3-9, LR (LENGTH TO CONFLUENCE POINT), ft

		1	2	3	4	6	8	7	8	9	19
	1	11.88699	11.93558	11.99317	12.65366	12.11767	12.18329	12.26233	12.32489	12.39855	12.4757 0
	2 3	11.88699	11.93558	11.99317	12.05366	12.11767	12.18329	12.25233	12.32469	12.39855	12.47576
	4	11.88 699 11. 96 715	11.93558 11.96182	11.99317 12.81945	12.85366 12.88884	12.117 6 7 12.14352	12.18329 12.2 6 982	12.25233	12.32469	12.39855	12.47578
:	5	11.90715	11.96182	12.61945	12.08004	12.14352	12.20982	12.27896 12.27896	12.35085 12.35085	12.42541 12.42541	12.50266
S	6	11.96715	11.96182	12.61945	12.68664	12.14352	12.20982	12.27896	12.35885	12.42541	12.5 6 266 12.5 6 266
	7	11.98618	12.03503	12.69285	12.15365	12.21734	12.28392	12.35336	12.42547	12.50038	12.57792
ne	8	11.98618	12.83563	12.89285	12.15365	12.21734	12.28392	12.36336	12.42547	12.50038	12.57792
Ľ	9	11.98618	12.83583	12.69285	12.15365	12.21734	12.28392	12.35330	12.42547	12.50038	12.57792
	16	12,16148	12.15666	12.21478	12.27591	12.33999	12.46766	12.47683	12.54945	12.62487	12.78296
ser	11	12.10148	12.15866	12.21478	12.27591	12.33999	12.467 66	12.47683	12.54945	12.62487	12.78296
Se	12	12.10148	12.15660	12.21478	12.27591	12.33999	12.46766	12.47683	12.54945	12.62487	12.70296
• •	13	12.27346	12.32898	12.38761	12.44925	12.51387	12.58147	12.65192	12.72522	12.80136	12.88021
~	14	12.27346	12.32898	12.38761	12.44925	12.51387	12.58147	12.65192	12.72522	12.80136	12.88621
a	15	12.27345	12.32898	12.38761	12.44925	12.51387	12.58147	12.65192	12.72522	12.86136	12.88621
9	16 17	12.49949 12.49949	12.55557 12.55557	12.61478 12.61478	12.677 <i>6</i> 7 12.677 <i>6</i> 7	12.74242 12.74242	12.81686	12.88259	12.95629	13.03334	13.11326
3	18	12.49949	12.55557	12.61478	12.87787	12.74242	12.81686	12.88289 12.88289	12.95629 12.95629	13.63334	13.11326
Ξ	19	12.78432	12.84169	12.96184	12.96418	13.03042	13.59976	13.17259	13.24742	13. 8 3334 13.32569	13.1132 <i>6</i> 13.46678
panwis	25	12.78432	12.84169	12.96164	12.96418	13.63642	13.69976	13.17289	13.24742	13.32569	13.46678
S	21	12.78432	12.84169	12.98184	12.96418	13.63642	13.69976	13.17289	13.24742	13.32569	13.46678
	22	13.13417	13.19178	13.25266	13.31683	13.38421	13.45472	13.52837	13.60565	13.68477	13.76746
	23	13.13417	13.19178	13.25266	13.31683	13.38421	13.45472	13.52837	13.66565	13.68477	13.76746
	24	13.13417	13.19178	13.25266	13.31683	13.38421	13.46472	13.52837	13.66565	13.68477	13.76746
		11	12	13	14	16	16	17	18	19	28
	1	12.55542	12.63773	12.72250	12.80972	12.89946	12.99138	13.88572	13.18226	13.28166	13.38197
	2	12.55542	12.63773	12.72256	12.86972	12.89946	12.99138	13.68572	13.18226	13.28166	13.38197
	3	12.55542	12.63773	12.72256	12.86972	12.89946	12.99138	13.68572	13.18226	13.28106	13.38197
ċ	4	12.58253	12.66495	12.74985	12.83725	12.92766	13.61918	13.11366	13.21641	13.36931	13.41043
Š	5	12.58253	12.88495	12.74985	12.83725	12.92766	13.61918	13.11366	13.21641	13.36931	13.41643
മ	6 7	12.58253 12.65813	12.66496 12.74688	12.74986 12.82619	12.83725 12.91399	12.92766 13.66416	13.61918 13.69676	13.11366	13.21641	13.36931	13.41643
Line	8	12.66813	12.74588	12.82619	12.91399	13.66416	13.89676	13.19164	13.28886 13.28886	13.38823	13.48984
Ξ	9	12.65813	12.74688	12.82619	12.91399	13.66416	13.69676	13.19164	13.28885	13.38823 13.38823	13.48984 13.48984
	19	12.78371	12.86756	12.95366	13.64141	13.13228	13.22559	13.32121	13.41914	13.51937	13.62175
ser	11	12.78371	12.86756	12.96346	13.64141	13.13228	13.22559	13.32121	13.41914	13.51937	13.62176
ú	12	12.78371	12.86756	12.95300	13.84141	13.13228	13.22559	13.32121	13.41914	13.51937	13.62175
R i	13	12.96175	13.64594	13.13277	13.22216	13.31393	13.46824	13.56496	13.66396	13.70523	13.86876
	14	12.96175	13.84594	13.13277	13.22216	13.31393	13.46824	13.56496	13.56396	13.70523	13.86876
ē	15	12.96175	13.64694	13.13277	13.22216	13.31393	13.46824	13.58496	13.66396	13.76523	13.86876
	16	13.19586	13.28111	13.36966	13.45961	13.55271	13.64834	13.74637	13.84679	13.94955	14.65459
3	17	13.19580	13.28111	13.36966	13.45961	13.55271	13.64834	13.74637	13.84679	13.94955	14.85459
Spanwise	18	13.19686	13.28111	13.36966	13.46961	13.55271	13.64834	13.74637	13.84679	13.94955	14.85459
يق	19	13.49674	13.57742	13.66687	13.75897	13.85364	13.95691	14.65864	13.98661	14.25746	14.36442
	2 5 21	13.49674 13.49674	13.57742 13.57742	13.66687 13.66687	13.75897 13.75897	13.85364 13.85364	13.95 0 91 13.95 0 91	14. 8586 4	13.98661	14.25746	14.36442
	22	13.85361	13.94145	14.83269	14.12663	14.22336	14.32256	14.42445	13.98661 14.52887	14.25745 14.63578	14.36442
	23	13.85301	13.94146	14.63269	14.12663	14.22336	14.32256	14.42445	14.52887	14.63576	14.745 8 1 14.745 8 1
	24	13.86301	13.94146	14.63269	14.12663	14.22336	14.32258	14.42445	14.52887	14.63578	14.74501
			- · · - · -		-						

TABLE 5.3-10, LP (LENGTH OF CONFLUENCE POINT TO TOP PLATE), ft

		1	2	3	4	5	6	7	8	9	16
	1	47.56714	47.69351	47.89263	48.16262	48.32505	48.55923	48.86492	49.66261	49.33636	49.68957
	2	47.50714	47.89351	47.89263	48.16262	48.32505	48.55923	48.86492	49.56251	49.33036	49.68967
	3	47.50714	47.89351	47.89263	48.16262 48.67624	48.32505	48.55923	48.8 6 492 48.77829	49. <i>6</i> 62 <i>6</i> 1 49. <i>6</i> 3526	49.33 030 49.3 0 345	49.6 0 957 49.58261
	4 5	47.48 69 8 47.48 69 8	47.66726 47.66726	47.86575 47.86575	48.67624	48.29859 48.29859	48.53269 48.53269	48.77829	49.83526	49.30345	49.58261
ė	8	47.48698	47.66726	47.86575	48.67624	48.29859	48.53269	48.77829	49.63525	49.30345	49.58261
N _o	7	47.46795	47.59466	47.79235	48.86262	48.22478	48.45859	48.78396	48.96663	49.22848	49.50735
Ð	8	47.46795	47.59466	47.79235	48.86262	48.22478	48.45859	48.70396	48.96663	49.22848	49.50735
Line	9	47.40795	47.59466	47.79235	48.66262	48.22478	48.45859	48.75396	48.96663	49.22848	49.50735
Ä	16	47.28665	47.47248	47.67842	47.88036	48.16213	48.33661	48.58643	48.83665	49.18398	49.38231
	11	47.28665	47.47248	47.67842	47.88636	48,10213	48.33551	48.58043	48.83665	49.10398	49.38231
er.	12 13	47.28685 47.11468	47.47248 47.36618	47.87 6 42 47.4 9 759	47.88 6 36 47.7 6 7 6 3	48.10213 47.92825	48.33551 48.161 <i>0</i> 6	48.58 6 43 48.4 6 633	48.83665 48.66Ø88	49.10398 48.92750	49.38231 49.2 6 566
15	14	47.11468	47.36616	47.49759	47.76763	47.92825	48.16166	48.40533	48.66088	48.92758	49,28686
œ	15	47.11468	47.38615	47.49759	47.70763	47.92825	48.16165	48.46533	48.66688	48.92758	49.28506
a	18	46.88864	47.87352	47.27842	47.47926	47.69978	47.93172	48.17516	48.42982	48.69652	48.97258
LA)	17	46.88864	47.87352	47.27642	47.47928	47.69978	47.93172	48.17516	48.42982	48.69552	48.97258
panwi	18	46.88864	47.87352	47.27642	47.47928	47.69976	47.93172	48.17516	48.42982	48.69552	48.97258
Ē	19	46.60381	46.78866	46.98416	47.19259	47.41176	47.84278	47.88617	48.13869	48.46317	48.67849
g	25	46.66381	46.78866	46.98416	47.19269	47.41176	47.64276	47.88517	48.13869	48.40317	48.67849
$\overline{\mathbf{s}}$	21	46.66381	46.78866	46.98416	47.19269	47.41176	47.84276	47.88617	48.13869	48.46317	48.67849
	22 23	46.25396 46.25396	46.4373 6 46.4373 6	46.63254 46.63254	46.83945 46.83945	47. <i>6</i> 5791 47. <i>6</i> 5791	47.2878 <i>6</i> 47.2878 <i>6</i>	47.52888 47.52888	47.781 <i>6</i> 6 47.781 <i>6</i> 6	48.64468 48.64468	48.31781 48.31781
	24	46.25396	46.43736	46.63254	46.83945	47.85791	47.28788	47.52888	47.78166	48.84468	48.31781
	••	40.2000	40140100					***************************************	***************************************	40.04.00	
		11	12	13	14	15	16	17	18	19	20
	1	49.89976	56.25642	58.51164	50.83312	51.16461	51.50602	51.85706	52.21761	62.58741	52,96634
	2	49.89976	50.25642	66.61164	50.83312	51.16461	51.56662	61.85706	52.21761	62.58741	52.96634
•	3	49.89976	58.28842	58.51164	56.83312	51.16461	51.58682	51.85765	52.21761	52.58741	52.96634
S	4	49.87259 49.87259	58.17326 58.17326	58.48429 58.48429	56.86559 56.86559	51.13695 51.13695	51.47822 51.47822	61.82911 61.82911	52.18947 52.18947	62.55916 52.55916	52.93788 52.93788
	5 8	49.87259	56.17326	58.48429	50.86559	51.13695	51.47822	51.82911	52.18947	52.55916	52.93788
ne	7	49.79698	58.69727	58.46795	68.72885	61.86984	51.46663	51.75113	52.11163	52.48524	52.85847
Lir	i	49.79698	50.69727	58.48795	56.72885	51.85984	51.46663	51.75113	62.11163	52.48024	52.85847
_	9	49.79698	56.69727	58.46795	56.72885	51.65984	51.46663	51.75113	62.11163	52.48624	52.85847
M	18	49.67141	49,97169	58.28114	55.66143	56.93173	51.27181	51.62156	61.98674	52.34916	52.72656
ser	11	49.87141	49.971 69	50.28114	56.56143	50.93173	51.27181	51.62158	51.98674	52.34916	52.72656
	12	49.67141	49.97169	56.28114	56.86143	50.93173	51.27181	51.82156	51.98074	52.34916	52.72656
Ri	13	49.49336	49.79221	50.10137	58.42874	50.75008	51.88916	51.43787	51.79598	52.16324	52.53955
U	14	49.49336	49.79221	58.18137	58.42874	50.75008	51.68916	51.43787 51.43787	51.79598	52.16324	52.53955 52.53955
Spanwise	16 18	49.49336 49.25931	49.79221 49.55764	58.18137 49.86588	56.42674 56.18323	50.75068 56.51130	51.88916 58.84966	51.43787 51.19646	51.79598 51.553 6 8	52.16324 51.91892	52.53955 52.29372
3	17	49.25931	49.55764	49.86568	55.18323	60.51136	58.84966	51.19648	51.553 68	51.91892	52.29372
Ē	18	49.25931	49.55764	49.86568	56.18323	50.51130	58.84966	51.19646	51.55368	51.91892	52,29372
Ď	19	48.96438	49.26673	49.56727	49.88387	56.21637	50.54648	56.89213	51.41326	51.61162	51.98389
S	29	48.96438	49.26673	49.56727	49.88387	50.21637	50.54648	58.89213	51.41326	51.61162	51.98389
	21	48.96438	49.26673	49.56727	49.88387	50.21037	50.54648	56.89213	51.41326	51.61162	51.98389
	22	48.66211	48.89678	49.25145	49.51621	49.84671	56.17484	56.51832	56.87161	51.23276	61.60330
	23	48.66211	48.89678	49.25145	49.51621	49.84671	56.17484	56.51832	50.87101	51.23276	51.66336
	24	48.60211	48.89678	49.25146	49.51621	49.84671	58.17484	50.51832	50.87191	61.23278	51.60330

TABLE 5.3-11, LA (EXPOSED LENGTH), ft

		1	2	3	4	6	6	7	8	9	18
	1	1.66831	6.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	6.88253
	2	1.66831	5.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	6.88253
	3	1.66831	6.99614	6.98341	6.97618	6.95648	0.94236	6.92786	6.91363	6.89796	6.88253
•	4	1.66831	8.99614	6.98341	6.97618	Ø.95648	8.94236	6.92786	8.91363	6.89796	6.88253
N _o	5	1.66831	6.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	Ø.88253
Z	6	1.66831	5.99614	6.98341	6.97018	6.95648	6.94236	6.92786	6.91303	8.89796	Ø.88253
Ð	7	1.00831	8.99614	6,98341	6.97618	6.95648	6.94236	6.92786	6.91363	0.89796	0.88253
Line	8	1.66831	6.99614	0.98341	6.97018	Ø.95648	8.94236	6.92786	6.91363	89798	8 .88253
3	9	1.66831	5.99614	6.98141	6.97018	Ø.95848	6.94236	6.92786	6.91363	6.89796	6 .88253
	18	1.66831	6.99614	6.98341	6.97618	0.95648	6.94236	6 .92786	6.91303	6.89796	0.88253
ser	11	1.00831	6.99614	6,98341	0.97018	6.95648	6.94236	Ø.92786	6.91363	6.89796	6.88253
Š	12	1.00831	6.99614	6.98341	6.97618	0.95548	6.94236	6.92786	6.91363	6.89796	0.88253
•=	13	1.66831	0.99614	6.98341	6.97618	0.95648	6.94236	6.92786	6.91363	6.89796	6.88253
œ	14	1.00831	0.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	0.89796	6.88253
a	15	1.00831	6.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	6.88253
9	16	1.66831	6.99614	6.98341	6.97618	6.95648	6.94236	0.92786	6.91363	6.89796	Ø.88253
3	17	1.86831	9.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	0.88263
panwi	18	1.66831	6.99614	6.98341	6.97618	6.95648	6.94236	6.92786	6.91363	6.89796	6.88263
ed.	19	1.66831	6.99614	6.98341	6.97618	6.95848	6.94236	6.92786	0.91303	6.89796	6 .88253
S	25	1.06831	6.99614	6.98341	6.97618	6.95548	6.94236	6.92786	6.91363	6.89796	Ø.88253
	21	1.56831	6.99614	0.98341	6.97618	8.95648 8.95648	6.94236	6.92786	0.91303	8.89798 8.89798	Ø.88253 Ø.88253
	22	1.00831	8.99614	8.98341 8.98341	6.97618 6.97618	Ø.95848	6.9 4236 6.9 4236	8.92786 6.92786	6.91363 6.91363	6.89796	6.88253
	23	1.66831	6.99614 5.99614	0.98341 0.98341	6.97818	Ø.95648	6 .94236	6 .92786	0.91363	8.89796	Ø.88253
	24	1.66831	8.88014	0.50371	0.07010	D. 20046	0.07250	0.02700	0.01503	0.00.00	5.00200
		11	12	13	14	15	16	17	18	19	28
	1	6.86694	6.85119	6.83536	Ø.81931	6.86325	6.78717	6.77169	6.75563	6.73963	6.72311
	2	6.86694	8.85119	6.83536	Ø.81931	6.86325	8.78717	6.77169	0.75503	6.73963	6.72311
•	3	8.86694	6.85119	6.83536	6.81931	6.86325	6.78717	6.77189	6.75563	6.73963	6.72311
Š	4	6.88694	0.85119	6.83536	6.81931	Ø.80325	6.78717	6.77169	0 .75503	8 .739 6 3	0.72311
	5	6.86694	9.85119	6.83536	6.81931	Ø.8 0 325	6.78717	8.77189	6.75563	0.73963	0.72311
Line	6	Ø.86694	6.85119	6.83536	6.81931	6.86325	0.78717	6.77169	6.75563	6.73963	6.72311
.E	7	6.86694	6.85119	6.83536	6.81931	6.86325	0.78717	6.77169	0.75563	6.73963	6.72311
Ä		8.86694	6.86119	6 .83536	6.81931	0.86325	6.78717	6.77169	6.75563	8.73963	6.72311
	8	8.86894	8.85119	0.83530	6.81931	6.86325	0.78717	6.77169	8.75583	8.73963	6.72311
ser	10	6.86694	8.85119	6.83536	6.81931	6.86325	6.78717	6.77189	6.75563	6.73963	6.72311
Ž	11	9.86694	6.85119	6.83536	6.81931	6.86325	0.78717	6.77169	6.75563	6.73963	6.72311
≅ :	12	6.86694	8.85119	Ø.8353 6	6.81931	6.86325	6.78717	6.77169	6.75563	6.73963	0.72311
	13	0.86694	6.85119	6.83536	Ø.81931	6.86325	Ø.78717	6.77169	6.75563	0.73963	0.72311
ข	14	8.86694	0.85119	6.83536	6.81931	0.86325	0.78717	8.77189	0.75503	Ø.739Ø3	Ø.72311
·~	15	6.86694	6.85119	6.83536	6.81931	6.86325	6.78717	6.77169	6.75563	6.73963	6.72311
3	16	6.88694	6.85119	6.83536	6.81931	Ø. 86325	6.78717	6.77169	6 .755 6 3	6.73963	Ø.72311
ຊ	17	6.86694	0.85119	0.83536	6.81931	6.86325	6.78717 4.78717	6.77169	6 .755 6 3	6.73963 6.73963	6.72311
Spanwise	18	6.86694	6.85119	6.83536	6.81931 6.81931	8.86325 8.86325	6.78717 6.78717	6.77169 5.77169	6.755 63 6.755 63	6.73963 6.73963	6.72311 6.72311
S	19	6.86694	0.85119	6.83536	6.81931 6.81931	Ø.86325	6.78717	6.77169	6.755 6 3	6.73963 6.73963	6.72311
	26	6.86694	6.85119	6.83536 6.83536	Ø.81931	6.86325	6.78717	8.77189	6.755 6 3	6.73963	6.72311
	21	6.86694	8.85119		6.81931	6.86 325	Ø.78717	6.77169	0.76563	6.73963	6.72311
	22 23	6.86694 6.86894	0.85119 0.85119	6.8353 6 6.8353 6	Ø. 01931	Ø. 96325	Ø.78717	6.77169	6.75503	6.73963	6.72311
	24	Ø. 86694	0.85119	Ø.8353Ø	Ø. 81931	0.86325	Ø.78717	0.77100	0.75503	0.73963	0.72311

TABLE 5.3-12, CDI (DRAG COEFFICIENT BASED ON INDIVIDUAL REF AREA)

Chordwise Riser Line No.

		1	2	3	4	, 6	6	7	8	9	16
	1	6.86282	6.66266	6.66198	8.66197	8.66195	6.66193	6.66191	6.66189	6.56187	0.86184
	2	6.66252	6.66266	6.56198	8.86197	6.66195	6.60193	6.66191	6.66189	6.66187	6.66184
	3	6.66252	6.66266	6.86198	6.56197	6.66195	6.66193	6.06191	6.66189	6.66187	6.66184
	4	6.86262	6.66266	6.66198	6.00196	6.66196	6.66193	6.66191	6.66189	6.66186	6.66184
No	5	0.00202	0.00200	6.66198	6.66196	0.00195	6.66193	6.66191	0.00189	0.66186	0.66184
Z	8	6.86262	6.00266	5.56198	6.63196	6.66195	6.66193	6.66191	6.66189	6.66186	6.66184
a	7	6.66261	6.66266	6.86198	6.66196	0.86194	8.86 192	6.66196	6.66188	6.66 186	0.86184
Line	8	6.86261	6.66266	5.66198	6.66196	6.66194	6.66192	6.66196	6.66188	6.66186	6.66184
· 	9	6.66261	6.66266	6.66198	6.66196	6.86194	6.66 192	6.86196	6.66188	6.60186	6.66184
	18	6.00251	6.66199	6.56197	6.86196	6.60194	6.66192	0.86196	6.66188	6.00186	6.66184
ser	11	6.66261	0.66199	6.96197	6.56196	6.66194	6.66192	6.06196	6.66188	6.66186	6.66184
9	12	6.96261	6.66199	6.86197	6.66196	6.66194	Ø. 86 192	6.66196	6.66188	6.66186	6.66184
.=	13	6.66266	6.66198	6.86197	6.66196	0.00193	0.66191	6.66189	6.60187	6.66185	6.66183
œ	14	6.66266	6.66198	6.66197	6.66196	6.66193	6.66191	6.66189	6.60187	6.66185	0.66183
a)	15	6.66266	6.66198	6.66197	6.66196	6.66193	6.66191	6.66189	6.60187	6.66186	6.66183
Ğ	16	6.66199	8.66197	6.66196	6.66194	6.66192	6.66196	6.06188	6.66186	6.66184	0.66182
	17	6.66199	6.66197	6.86196	6.86194	6.60192	6.66196	6.86188	0.06186	6.66184	8.86182
ž	18	6.66199	6.56197	6.86196	6.86194	6.66192	6.66196	6.86188	6.66186	6.66184	6.66182
Spanwise	19	6.66198	6.66196	6.66195	6.66193	6.66191	8.66189	6.66187	6.66185	6.66183	6.66181
Ġ.	26	6.66198	6.66196	8.86195	6.66193	8.86191	8.86189	6.86187	6.66185	6.66183	6.66181
01	21	6.66198	6.66196	6.66195	6.66193	6.66191	6.66189	6.66 187	6.66185	6.56183	0.66181
	22	6.86196	6.66195	6.66193	6.66191	6.66196	6.66188	6.66186	6.66184	6.66182	6.66186
	23	8.88196	6.66195	0.86193	0.66191	6.66196	6.66188	6.86186	6.66184	6.66182	0.66186
	24	6.66198	8.86195	6.66193	6.66191	6.66196	6.66 188	6.66186	6.66184	6.66182	0.06186
		11	12	13	14	15	16	17	18	19	20
	1	6.66182	6.00186	6.56178	6.66175	6.60173	0.66171	6.96168	6.86166	6.86164	6.66161
	2	0.66182	6.66186	8.86178	6.56175	6.66173	8.86171	9.90168	0. 56 166	0.66 164	6.66161
ė	3	8.86182	6.60186	0.66178	8.66 175	8.86173	0.56171	6.66168	0.96 166	6.60164	6.66161
8	4	0.66 182	6.66186	6.66178	6.66175	6.66173	6.66171	6.66168	5.56166	6.06164	6.66161
41	6	0.66182	6.66186	6.66178	A A417E						
Line	6				8.86175	6.66173	6.66171	6.66168	6.90166	0.66164	6.86181
•		8.86 182	6.66186	6.66178	6.66175	6.66173	6.86171	6.66168	6.90166 6.66166	6.66164	6.66161
	7	8.86182 8.86182		6.66178 6.66177	6.66175 6.66175	8.66173 8.66173	6.86171 6.86176	6.86168 6.86168	6.96166 6.86166 6.86166	6.66164 6.66163	6.66161 6.66161
_	7 8	6.66182 6.66182	6.66186 6.66186 6.66186	8.86178 8.86177 8.86177	6.86175 6.86175 6.86175	0.80173 0.60173 0.66173	6.86171 6.86176 6.86176	0.00168 0.00168 0.00168	6.96166 6.96166 6.96166	6.66164 6.66163 6.66163	6.66161 6.66161 6.66161
	7 8 9	8.86182 8.86182 8.86182	6.06186 6.06186 6.06186 6.06186	8.86178 6.96177 9.86177 8.86177	6.86175 6.86175 6.86175 6.86175	6.66173 6.66173 6.66173	6.96171 6.96176 6.96176 6.96176	6.86168 6.86168 6.86168 6.86168	6.96166 6.96166 6.96166 6.96166	6.66164 6.66163 6.66163 6.66163	6.66161 6.66161 6.66161 8.66161
	7 8 9 16	6.66182 6.66182 6.66182 6.66181	6.66186 6.66186 6.66186 6.66179	8.86178 8.96177 8.86177 6.66177 8.86177	6.86175 6.86175 6.86175 6.86175	6.86173 6.66173 6.66173 6.66173	6.86171 6.86176 6.86176 6.86176 6.86176	6.86168 6.86168 6.86168 6.86168	6.96166 6.96166 6.96166 6.96166 6.96166	6.86164 6.86163 6.86163 6.86163	6.66161 6.66161 6.66161 6.66161 6.66161
	7 8 9 16 11	6.56182 6.56182 6.56182 6.66181 6.56181	6.66186 6.66186 6.66186 6.66179 6.66179	8.86178 8.86177 8.86177 8.86177 8.86177	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175	6.66173 6.66173 6.66173 6.66173 6.66172	6.86171 6.86176 6.86176 6.86176 6.86176 5.86176	6.96168 6.96168 6.96168 6.96168 6.96168	6.96166 6.96166 6.96166 6.96166 6.96165 6.96165	6.86164 6.86163 6.86163 6.86163 6.86163	5.66161 5.66161 5.66161 6.66161 6.66161
Riser l	7 8 9 16	6.66182 6.66182 6.66182 6.66181	6.66186 6.86186 6.86186 6.86186 6.86179 6.86179	6.86178 6.96177 6.86177 6.86177 6.86177 6.86177	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175	6.86173 6.66173 6.66173 6.66173 6.66172 6.66172	6.96171 6.96176 6.96176 6.96176 6.96176 6.96176 6.96176	6.96168 6.96168 6.96168 6.96168 6.96168 5.96168	8.98166 9.86166 9.86166 9.86166 9.86165 9.86165 9.86165	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163	6.66161 6.66161 6.66161 6.66161 6.66161 6.66161
Riser	7 8 9 16 11 12 13	8.86182 8.86182 8.86182 8.86181 8.86181 8.86181	6.66186 6.66186 6.66186 6.66179 6.66179 6.66179	6.86178 6.96177 6.86177 6.86177 6.86177 6.86177 6.86177	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175 6.86175	8.66173 6.66173 6.66173 6.66173 6.66172 6.66172 6.66172	6.96171 6.96176 6.96176 6.96176 6.96176 6.96176 6.96176 6.96176	6.96168 6.96168 6.96168 6.96168 6.96168 6.96168 6.96168	6.00166 5.00166 6.00166 6.00166 6.00165 6.00165 6.00165 6.00165	6.00164 6.00163 6.00163 6.00163 6.00163 6.00163 6.00163	6.66161 6.66161 6.66161 6.66161 6.66161 6.66161 6.66161
Riser	7 8 9 16 11 12 13	6.86182 6.86182 6.86182 6.86181 6.86181 6.86181 6.86181	5.66186 5.66186 6.66186 6.66179 5.66179 6.66178 6.66178	8.86178 8.86177 8.86177 6.86177 8.86177 8.86177 6.86176 6.86176	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175 6.86174 6.86174	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172	6.86171 6.86176 6.86178 6.86178 6.86176 6.86176 6.86176 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96168 6.96168 6.96167	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86163 6.86163	5.96161 5.96161 6.96161 6.96161 6.96161 6.96161 6.96161 6.96166
Riser	7 8 9 16 11 12 13 14 15	6.86182 6.86182 6.66181 6.86181 6.86181 6.86181 6.86181 6.86181	6.66186 6.66186 6.66186 6.66179 6.66179 6.66178 6.66178 6.66178	8.86178 8.86177 8.86177 6.86177 6.86177 6.86177 6.86176 6.86176	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175 6.86174 6.86174	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66172	6.86171 6.86176 6.86178 6.86178 6.86178 6.86176 6.86176 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162	5.96161 5.96161 6.96161 8.96161 6.96161 6.96161 6.96161 6.96166 6.96166
Riser	7 8 9 16 11 12 13 14 15	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181	6.66186 6.66186 6.66186 6.66179 6.66179 6.66178 6.66178 6.66178 6.66178	8.86178 6.96177 8.86177 6.86177 6.86177 6.86176 6.86176 6.66176	6.66175 6.66175 6.66175 6.66175 6.66175 6.66175 6.66174 6.66174 6.66174	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66172 6.66172	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96167	6.96166 6.96166 6.96166 6.96166 6.96165 6.96165 6.96165 6.96165 6.96165 6.96165	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162	5.96161 5.96161 6.96161 6.96161 6.96161 6.96161 6.96166 6.96166 6.96166 6.96166
Riser	7 8 9 16 11 12 13 14 15 16	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181	6.66186 6.66186 6.66186 6.66179 6.66179 6.66178 6.66178 6.66178 6.66178	6.86178 6.96177 6.86177 6.86177 6.86177 6.86176 6.86176 6.86176 6.86176 6.86176	6.66175 6.66175 6.66175 6.66175 6.66175 6.66175 6.66174 6.66174 6.66174 6.66173	6.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96167 6.96166	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165 6.86164	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162	5.86161 6.86161 6.86161 6.86161 6.86161 6.86161 6.86166 6.86166 6.86166 6.86169 6.86169 6.86169
Riser	7 8 9 16 11 12 13 14 15 16 17	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186	6.06186 6.06186 6.06186 6.06179 6.06179 6.06178 6.06178 6.06178 6.06178	8.86178 8.86177 8.86177 8.86177 8.86177 8.86177 8.86176 6.86176 6.86176 6.86176	6.66175 6.66175 6.66175 6.66175 6.66175 6.86175 6.86174 6.86174 6.86174 6.86174 6.86173	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96167 6.96166 6.96166	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164	8.80164 6.96163 8.00163 6.96163 6.96163 6.96163 6.96162 6.96162 6.96162 6.96162 6.96162 6.96162	5.96161 6.96161 6.96161 6.96161 6.96161 6.96161 6.96166 6.96166 6.96169 8.96169 8.96169 8.96169
	7 8 9 16 11 12 13 14 15 16 17 18	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186 6.66186	6.06186 6.06186 6.06186 6.06179 6.06179 6.06178 6.06178 6.06178 6.06178 6.06178 6.06178	8.86178 8.86177 8.86177 8.86177 8.86177 8.86176 6.86176 6.86176 6.86176 6.86176	6.66175 6.66175 6.66175 6.66175 6.66175 6.66175 6.66174 6.66174 6.66174 6.66173 6.66173 6.66173	6.66173 6.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171 6.66171 6.66171	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96167 6.96166 6.96166 6.96166	8.89186 5.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164 6.86164 6.86164	6.86164 6.96163 6.96163 6.96163 6.96163 6.96162 6.96162 6.96162 6.96162 6.96162 6.96162 6.96162 6.96162	6.96161 6.96161 6.96161 6.96161 6.96161 6.96161 6.96166 6.96166 6.96166 8.96169 6.96169 6.96169 6.96169
Riser	7 8 9 16 11 12 13 14 15 16 17 18 19 25	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186 6.66186 6.66179 6.66179	6.06186 6.06186 6.06186 6.06179 6.06179 6.06178 6.06178 6.06178 6.06178 6.06178 6.06177 6.06177	8.86178 6.86177 8.86177 8.86177 8.86177 8.86176 6.86176 6.66176 6.66175 6.86175 8.86174 8.86174	6.66175 6.66175 6.66175 6.66175 6.66175 6.86175 6.86174 6.86174 6.86174 6.86173 6.86173 6.86173 6.86173	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171 6.66171 6.66171	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96167 6.96166 6.96166 6.96166 6.96166	6.86166 6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164 6.86164 6.86163	6.86164 6.96163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162	6.00161 6.00161 6.00161 6.00161 6.00161 6.00161 6.00166 6.00166 6.00166 6.00169 6.00169 6.00169 6.00169 6.00169
Riser	7 8 9 16 11 12 13 14 15 16 17 18 19 28 21	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186 6.66186 6.66187 7.66179	6.66186 6.66186 6.66186 6.66179 6.66179 6.66178 6.66178 6.66178 6.66178 6.66178 6.66177 6.66177	6.06178 6.06177 6.06177 6.06177 6.06177 6.06176 6.06176 6.06176 6.06176 6.06176 6.06176 6.06176	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175 6.86174 6.86174 6.86174 6.86173 6.86173 6.86173 6.86173	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171 6.66171 6.66176 6.66178	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96166 6.96166 6.96166 6.96165 6.96165	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164 6.86164 6.86164 6.86163	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162	6.00161 6.00161 6.00161 6.00161 6.00161 6.00161 6.00166 6.00166 6.00169 6.00169 6.00169 6.00169 6.00169
Riser	7 8 9 16 11 12 13 14 15 16 17 18 19 26 21 22	6.86182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186 6.66186 6.66187 9.66179 9.66179	6.06186 6.06186 6.06186 6.06179 6.06179 6.06178 6.06178 6.06178 6.06178 6.06178 6.06177 6.06177	6.06178 6.06177 6.06177 6.06177 6.06177 6.06176 6.06176 6.06176 6.06176 6.06176 6.06176 6.06174 6.06174 6.06174 6.06174	6.86175 6.86175 6.86175 6.86175 6.86175 6.86174 6.86174 6.86174 6.86174 6.86173 6.86173 6.86173 6.86173	6.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171 6.66171 6.66176 6.66176	6.86171 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86168 6.86168 6.86168	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96166 6.96166 6.96166 6.96166 6.96165 6.96165	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164 6.86164 6.86163 6.86163 6.86163	6.86164 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162 6.86162 6.86161 6.86161 6.86161 6.86161	6.00161 6.00161 6.00161 6.00161 6.00161 6.00166 6.00166 6.00166 6.00169 6.00169 6.00169 6.00169 6.00169 6.00169 6.00169
Riser	7 8 9 16 11 12 13 14 15 16 17 18 19 28 21	6.66182 6.66182 6.66181 6.66181 6.66181 6.66181 6.66181 6.66186 6.66186 6.66186 6.66187 7.66179	6.66186 6.66186 6.66186 6.66179 6.66179 6.66178 6.66178 6.66178 6.66178 6.66178 6.66177 6.66177	6.06178 6.06177 6.06177 6.06177 6.06177 6.06176 6.06176 6.06176 6.06176 6.06176 6.06176 6.06176	6.86175 6.86175 6.86175 6.86175 6.86175 6.86175 6.86174 6.86174 6.86174 6.86173 6.86173 6.86173 6.86173	8.66173 6.66173 6.66173 6.66172 6.66172 6.66172 6.66172 6.66172 6.66171 6.66171 6.66171 6.66176 6.66178	6.86171 6.86176 6.86176 6.86176 6.86176 6.86176 6.86169 6.86169 6.86169 6.86169 6.86169 6.86169	6.96168 6.96168 6.96168 6.96168 6.96168 6.96167 6.96167 6.96166 6.96166 6.96166 6.96165 6.96165	6.86166 6.86166 6.86166 6.86166 6.86165 6.86165 6.86165 6.86165 6.86165 6.86164 6.86164 6.86164 6.86164 6.86163	6.86164 6.86163 6.86163 6.86163 6.86163 6.86163 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162 6.86162	6.00161 6.00161 6.00161 6.00161 6.00161 6.00161 6.00166 6.00166 6.00169 6.00169 6.00169 6.00169 6.00158

TABLE 5.3-13, CD2 (DRAG COEFFICIENT BASED ON TOTAL LINE REF AREA)

		1	2	3	4	6	6	7	•	9	10
	1	6.86618	6.56618	6.66617	6.86617	6.56617	6.66617	6.66617	6.56617	6.66616	8.86018
	ž	6.6661B	5.66618	6.66617	8.66617	0.66617	6.00617	6.66617	6.66617	6.66616	8.60616
	3	6.66618	6.86618	6.66617	9.00017	6.88617	0.66017	6.66617	6.86617	6.66616	6.66616
	4	6.50618	6.06618	6.00617	6.86617	6.66617	6.66617	8.66617	6.66617	Ø. 666 16	6.66616
:	5	6.66618	6.55618	6.86617	6.86617	6.88817	6.66617	6.00617	6.66617	6.66616	6.66618
Š	6	6.666 18	6.66618	8.66617	6.88617	6 . 886 17	8.66617	6.66617	6.00017	6.66616	6. 066 16
	7	6.806 18	Ø.06618	0.886 17	6.66017	6.86017	8.506 17	6.66617	8.000 17	6.66616	8. 666 16
Line	8	6.66618	6.56618	6.66617	6.86617	0.00017	6.66617	6.66617	6.88817	6.00016	6.66616
٠	9	8.86618	6.66618	0.00017	6.86817	6.66617	6.00017	6.00617	6.88617	6.00618	0.00016
-1	10	6.66618	6.66618	0.00617	6.66617	0.86617	8.66617	6.66617	6.66617	6.86616	6.86616
54	11	6.88618	0.86618	6.66617	6.66617	6.66017	8.86617	8.88617	8.88617	6.66616	6.86616
ä	12	6.00018	6.56618	6.66617	6.50617	6.66617	6.66617	0.00017	6.86617	6.00016	6.00616
	13	6.66618	6.66618	6.66617	6.66617	6.66617	0.00017	0.00017	6.86617	6.00016	6.86616
æ	14	6.86618	6.96618	6.66617	6.66017 6.66617	6.86617	6.86617 6.86617	6.66617 6.66617	6.00017	6.00016 6.00016	8.80616 8.86616
ย	15	6.66618	6.66618	6.56617		6.66617	•		6.06617	6.00016	6.00016
úŠ.	16	6.66618	6.60617 6.60617	6.66617 6.66617	8.66617 8.66017	6.66617 6.66617	6.66617 6.66617	8.86617 8.86617	6.86616 6.66616	6.66 016	6.66616
panwi	17	6.66618 6.66618	8.86617	6.66617	6.66617	6.66817	6.66617	6.66617	6.00016	6.66616	6.00016
ž	18 19	6.866 17	6.88817	6.00017	6.66617	5.88617	6.56617	0.00017	6.66616	5.00016	6.56616
63	25	8.86617	6.66617	6.00017	6.96817	8.86617	6.66617	0.00617	0.00010	6.00016	6.66616
ď	21	6.96617	6.66617	6.58617	6.66817	8.66017	8.55517	6.50617	6.66616	6.86616	6.56616
41	22	6.86617	8.86617	6.86617	8.88617	6.86617	8.86617	6.56616	6.86616	6.50616	6.60616
	23	8.66617	6.86617	6.00017	6.66617	6.00617	6.66617	0.00616	6.00016	6.00016	6.00616
	24	6.86617	6.00017	0.00017	6.56617	6.80017	8.86617	8.50616	6.86618	6.56616	6.00016
		11	12	13	14	16	16	17	18	19	2●
	1	5.00616	6.66616	6.00016	6.66615	6.86615	6.66615	6.66615	6.86615	6.86614	#. 966 14
	ž	0.66616	6.00018	6.66616	6.00615	6.66615	8.66615	6.60616	6.66615	6.56614	6.66614
	3	6.00016	5.56616	6.56616	0.66615	6.66615	8.96615	6.56616	6.66615	6.86614	8.66614
	4	8.66616	6.56616	6.66616	6.66615	6.66615	6.66615	0.86615	6.86615	6.66614	6.00014
N _o	5	8.86616	6.66616	6.66616	6.966 15	0.00015	6.666 15	6.66615	6.56615	6.86614	6.866 14
Z	6	6.66616	6.66616	6.666 16	6.866 15	6.886 15	6.666 15	6. 000 15	6.66615	9.56614	9.86614
9	7	5.006 18	8.866 16	6.666 18	5.866 15	8.86615	6.56615	0.66615	6.866 15	0.66614	6.66614
Line	•	6.00016	8.66616	6.66616	6.66615	8.56615	0.00015	6.66615	0.66615	6.66614	0.00014
:	9	6.000 16	0.66618	6.60016	6.66615	0.80615	8.00015	8.86615	8.66615	8.86614	6.00614
	1.	6.66618	6.66616	6.66616	6.66615	8.66615	6.66615	6.66618	6.66615	6.80614	6.00614
Riser	11	0.86616	6.66616	6.66616	6.66615	6.66615	0.00015	0.00015	6.66615	8.86614	5.50014
Š	12	6.90616	6.56616	6.66016	6.66615	6.88615	6.86615	6.66615	6.90615	6.00014	6.66614 6.66614
***	13	6.00018	6.66616	6.56616	6.66615	6.66616	6.00015	6.00015	6.66615	6.00614	8.00014
-	14	6.00016	0.00016	6.66616 6.66616	6.66615 6.66615	6.66615 6.66615	6.86615 6.66615	6.00015 6.00015	6.66615 6.66615	6.66614 6.66614	6.86614
ສ	15	6.66616 6.66616	8.56616 8.56616	8.66615	6.00015	6.66615	6.00015	6.66615	6.66614	6.86614	8.00014
3	16	6.56616	8.80616 6.80616	6.66615	8.86615	0.50015	0.00015	6.90615	6.56614	6.86614	9.00614
3	17 18	5.56516	0.00016 0.00016	6.86615	6.566 15	6.56615	6.66615	6.66615	8.66614	8.66614	6.50614
Spanwi	19	0.000 18	6.56618	6.66615	8.866 15	6.56615	6.66615	6.56615	6.50014	6.00014	0.86614
2	28	6.000 18	5.50016	8.88815	8.86615	6.56615	6.66615	0.50615	0.55614	6.86614	6.00014
S	21	8.50616	5.50016	6.66615	6.00015	6.86615	8.60615	6.00015	6.56614	5.00614	6.56614
	22	9.00018	0.00015	0.00015	9.00015	8.00015	8.99615	6.80014	8.80614	5.80014	6.00014
	23	6.00016	0.00015	0.00015	8.00015	0.80615	6.00615	0.00014	8.00014	0.00014	0.80014
	24	Ø. 00016	0.00015	6.00016	0.00015	0.00015	0.00015	8.80014	0.00014	0.00014	9.80014

TABLE 5.3-14, CD3 (DRAG COEFFICIENT BASED ON PARAFOIL REF AREA)

		1	2	3	4	6	6	7	8	9	16
	1	-6.97586	-8.97586	-6.97586	-6.97586	-6.97566	-6.97586	-8.97586	-6.97566	-6.97566	-0.97566
	2	6.22566	8.22566	6.22566	6.22566	6.22566	6.22566	6.22566	6.22566	6.22566	8.22580
	3	1.42586	1.42566	1.42566	1.42566	1.42566	1.42500	1.42566	1.42566	1.42566	1.42566
ċ	4	2.62586	2.62566	2.62566	2.82500	2.62586	2.62586	2.62506	2.62506	2.82566	2.62500
S N	5	3.82566	3.82566	3.82566	3.825 <i>66</i>	3.825 <i>86</i>	3.82566	3.82586	3.82566	3.82500	3.82500
41	6	5 . 6 25 06	5. 0 25 06	6.82588	5.82566	5. <i>0</i> 25 <i>06</i>	5.02500	5.825 <i>86</i>	5.82586	5. 0 25 00	5.02500
Line	7	6.225 66	6.22 500	6.225 <i>66</i>	6.225 <i>66</i>	6.22566	6.225 <i>66</i>	6.22586	6.22566	6.22506	6.22566
4	8	7.42566	7.42566	7.425 66	7.425 06	7.425 66	7.425 66	7.425 00	7.425 00	7.42506	7.425 00
—	9	8.62586	8.62500	8.825 <i>66</i>	8.62566	8.62586	8.62566	8.625 <i>66</i>	8.625 <i>66</i>	8.62566	8.625 <i>6</i> 6
54	10	9.82586	9.82566	9.82566	9.82566	9.82588	9.82566	9.82566	9.825 <i>66</i>	9.825 <i>06</i>	9.82566
ser	11	11.62566	11.02500	11.82566	11.62566	11.62566	11.62566	11.62566	11.02500	11.02500	11.82586
•	12	12.22586	12.22500	12.22566	12.22566	12.22586	12.22566	12.22566	12.22566	12.22566	12.22566
04	13	13.42566	13.42500	13.42566	13.42506	13.42500	13.42566	13.42566	13.42566	13.42566	13.42566
a	14	14.62566	14.62566	14.62566	14.62500	14.82500	14.62566	14.62566	14.62566	14.62566	14.825
56	15	15.825 86 17. 8 25 86	15.825 06 17. 6 25 06	15.825 66 17. 8 25 66	15.82566	15.82500	15.82566	15.82566	15.82566	15.82566	16.82588
:\$	16 17	18.22586	18.22586	18.22586	17. 82586 18.225 66	17.62566 18.22566	17. 8 25 66 18.225 66	17.82586 18.22586	17.82588	17.82586	17.82588
Ē	18	19.42586	19.42586	19.42566	19.42566	19.42566	19.42566	19.42566	18.225 66 19.425 66	18.225 66 19.425 66	18.225
panwi	19	28.62588	28.62566	28.62588	29.62566	28.62586	20.62666	28.62588	26.62566	28.62566	19.425 00 26.625 00
Š	25	21.82566	21.82500	21.82566	21.82566	21.82586	21.82566	21.82586	21.82566	21.82566	21.825
	21	23.62566	23.62566	23.82500	23.62566	23.62566	23.62566	23.62566	23.82586	23.92500	23.82586
	22	24.22586	24.22586	24.22586	24.22500	24.22586	24.22566	24.22586	24.22588	24.22566	24.22586
	23	25.42566	25.42586	25.42586	25.42566	25.42566	25.42566	25.42586	25.42566	25.42566	25.42500
	24	26.62566	26.62566	26.62566	26.62500	26.62586	26.62566	26.62556	26.62566	26.62566	26.62500
		11	12	13	14	15	16	17	18	19	20
	1	11 -6.97566	12 -6.975 86	13 -6.97586	14 -6.97506	15 -6.975 86	16 -6.97586	17 -0.97586	18 -6.97586	19 -6.97586	28 -6.97588
	2	-0.97586 6.22586		-6.97586 6.22586							_
•	2	-8.97586 8.22586 1.42588	-6.97566 6.22566 1.42566	-6.97586 6.22586 1.42586	-6.97506 6.22506 1.42506	-6.97566 6.22566 1.42566	-6.97586 6.22586 1.42586	-0.97586	-6.97586	-6.97586	-6.97586
۲o.	2 3 4	-8.97586 8.22586 1.42586 2.82586	-6.97586 6.22586 1.42586 2.62586	-6.97586 6.22586 1.42586 2.62586	-6.97506 6.22506 1.42506 2.62606	-6.97566 6.22566 1.42566 2.62566	-6.97586 6.22586 1.42586 2.62586	-0.97586 6.22586 1.42586 2.62686	-6.97566 6.22566 1.42566 2.62566	-6.97506 6.22506	-6.975 66
No.	2 3 4 6	-8.97586 8.22586 1.42586 2.62586 3.82586	-8.97588 8.22588 1.42586 2.62586 3.82588	-6.97586 6.22586 1.42586 2.62566 3.82566	-6.97506 8.22506 1.42506 2.62506 3.82506	-6.97586 6.22586 1.42586 2.62586 3.82586	-6.97586 6.22586 1.42586 2.62586 3.82586	-0.97586 6.22586 1.42586 2.62586 3.82586	-6.97508 6.22506 1.42506 2.62506 3.82506	-6.97506 0.22506 1.42506 2.82506 3.82506	-0.97586 6.22586 1.42586 2.82586 3.82586
	2 3 4 6	-0.97586 8.22586 1.42586 2.62586 3.82586 6.82586	-0.97586 0.22586 1.42586 2.62586 3.82586 5.82586	-8.97586 8.22586 1.42586 2.62586 3.82586 6.82586	-6.97506 8.22506 1.42506 2.62506 3.82506 5.82500	-8.97586 8.22586 1.42586 2.62586 3.82586 5.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82588	-0.97586 6.22586 1.42586 2.62586 3.82586 5.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.62586	-6.97586 8.22586 1.42586 2.62586 3.82586 5.82588	-0.97500 0.22500 1.42500 2.62500 3.82500 5.82500
	2 3 4 6 6 7	-0.97586 0.22586 1.42586 2.62586 3.82586 5.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82580 6.22588	-8.97586 8.22586 1.42586 2.62586 3.82586 6.82586	-6.97506 8.22506 1.42506 2.62506 3.82506 5.82506	-8.97586 8.22586 1.42586 2.62586 3.82586 5.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.62586	-6.97586 8.22586 1.42586 2.62586 3.82586 6.82586	-0.97500 6.22500 1.42500 2.82500 3.82500 5.82500 6.22500
Line No.	2 3 4 5 6 7	-0.97586 0.22586 1.42586 2.82586 3.82586 5.82586 6.22586 7.42586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22588 7.42586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.82506 6.22506 7.42506	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586	-6.97566 6.22566 1.42586 2.62566 3.82566 5.82566 6.22566 7.42566	-6.97566 6.22566 1.42566 2.62566 3.82566 5.82586 6.22586 7.42566	-6.97566 6.22566 1.42566 2.62566 3.82566 5.62566 6.22566 7.42586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.62506 6.22506 7.42506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500
Line	2 3 4 6 6 7	-6.97586 6.22586 1.42586 2.62586 3.82586 6.82586 6.22586 7.42586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22588 7.42586 8.62586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586	-6.97566 6.22566 1.42586 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566	-6.97566 6.22566 1.42566 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.82588	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 7.42586 8.62586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 6.22506 7.42506 8.62506
Line	2 3 4 5 6 7 8	-0.97586 8.22586 1.42586 2.62586 3.82586 6.82586 6.22586 7.42586 8.82586	-0.97586 0.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.82586 6.22586 7.42586 9.82586	-6.97586 8.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 7.42586 9.82586	-6.97566 6.22566 1.42586 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 9.82566	-6.97566 6.22566 1.42566 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 9.82566	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586	-6.97586 6.22586 1.42586 2.82586 3.82586 6.82586 6.22586 7.42586 9.82586	-6.97500 6.22506 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500
Line	2 3 4 6 7 9 18	-0.97586 6.22586 1.42586 2.82586 3.82586 6.82586 6.22586 7.42586 9.82586 9.82586	-8.97506 8.22506 1.42506 2.62506 3.82506 5.82506 6.22506 7.42506 8.62506 9.82506 11.82506	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 9.82586 9.82586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.92506 6.22506 7.42506 8.62506 9.82506 11.82506	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586	-6.97566 6.22566 1.42566 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 9.82566 11.82566	-0.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 9.82586 9.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.82586 9.82586 11.82586	-6.97506 6.22506 1.42506 2.52506 3.82500 5.02506 6.22506 7.42506 8.62506 9.82506 11.02506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.82500 6.22500 7.42500 9.82500 11.82500
iser Line	2 3 4 5 6 7 9 18 11 12	-6.97586 8.22586 1.42586 2.82586 3.82586 6.82586 7.42586 9.82586 11.82586	-8.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.82586 7.42586 8.62586 9.82586 11.82586 12.22586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.02506 6.22506 7.42506 8.62506 9.82506 11.02506 12.22506	-0.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 11.82586 11.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.82586 9.82586 11.82586 12.22586	-6.97506 6.22506 1.42506 2.52506 3.82506 6.22506 7.42506 8.62506 11.82506 12.22506	-8.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500 11.82500 12.22500
Riser Line	2 3 4 6 6 7 8 9 18 11 12 13	-0.97506 0.22506 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 9.82500 11.82500 12.22500 13.42500	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586 11.92586 12.22586 13.42586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.92506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 9.82586 11.82586 12.22586 13.42586	-6.97566 6.22566 1.42586 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 9.82566 11.82566 12.22566 13.42566	-0.97586 6.22586 1.42586 2.82586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42566	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62588 9.82586 11.82586 12.22586 13.42586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500 11.82500 12.22500 13.42500
Riser Line	2 3 4 6 6 7 8 9 18 11 12 13 14	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 9.82586 11.82586 12.22586 13.42586	-0.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 9.82500 11.92500 12.22500 13.42500 14.62500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586	-6.97566 6.22566 1.42586 2.62566 3.82566 6.22566 7.42566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.82586 9.82586 11.82586 11.82586 13.42586 14.62586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 11.82506 13.42506 14.62506	-0.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 9.82500 11.82500 12.22500 13.42500 14.62500
Riser Line	2 3 4 5 6 7 9 10 11 12 13 14 15	-0.97586 6.22586 1.42586 2.82586 3.82586 6.22586 7.42586 8.82586 9.82586 11.82586 11.82586 12.22586 14.62586 16.82586	-0.97586 0.22586 1.42586 2.02586 3.82586 5.82586 6.22586 7.42586 9.82586 11.92586 12.22586 14.62586 14.62586 15.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 15.82586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 7.42506 8.62500 9.82506 11.82506 12.22506 14.62506 15.82506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 15.82586	-6.97566 6.22566 1.42586 2.62566 3.82566 6.22566 7.42566 8.62566 9.82566 11.62566 12.22566 14.62566 15.82566	-0.97586 6.22586 1.42586 2.82586 5.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 14.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 15.82586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 14.62506 15.82506	-0.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500 11.62500 12.22500 13.42500 14.62500 16.82500
Riser Line	2 3 4 6 7 9 10 11 12 13 14 15 16	-0.97586 6.22586 1.42586 2.82586 6.82586 6.22586 7.42586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586	-0.97500 0.22500 1.42500 2.62500 3.82500 5.82500 6.22500 7.42500 8.62500 9.82500 11.92500 12.22500 14.62500 15.82500 17.82500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586	-6.97506 8.22506 1.42506 2.62506 3.82500 5.92500 6.22506 7.42506 8.62500 9.82500 11.82500 12.22500 13.42500 14.62500 15.82500 17.82500	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586	-6.97566 6.22566 1.42566 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566 15.82566 17.82566	-0.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586	-6.97506 6.22506 1.42506 2.52506 3.82500 5.02500 7.42500 8.62500 9.82500 11.02500 12.22500 14.62500 14.62500 17.02500	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 6.22500 8.62500 9.82500 11.82500 12.22500 14.62500 14.62500 15.82500 17.82500
Riser Line	2 3 4 6 7 9 1 1 1 1 1 2 1 3 1 4 1 5 1 6 7	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 17.82586 17.82586 17.82586	-8.97506 8.22506 1.42506 2.62506 3.82506 5.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 18.22506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 18.22586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.92506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22500 13.42506 14.62506 15.82506 17.82506 18.22506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 15.82586 17.82586 18.22586	-6.97566 6.22566 1.42566 2.62566 5.82566 6.22566 7.42566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566 17.82566 17.82566 18.22566	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 18.22586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 18.22586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 18.22506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 11.82500 12.22500 13.42500 14.62500 15.82500 17.82500 18.22500
iser Line	2 3 4 6 7 9 1 1 1 1 1 2 1 3 1 4 1 5 1 6 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-6.97586 8.22586 1.42586 2.82586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 17.82586 17.82586 17.82586	-8.97588 6.22588 1.42588 2.62588 5.82588 6.22588 7.42588 8.62588 9.82588 11.82588 12.22588 13.42588 14.62588 17.82588 18.22588	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 11.82586 12.22586 14.62586 17.82586 17.82586 18.22586 19.42586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22500 13.42506 14.62506 17.82506 17.82506 19.42506	-8.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 18.22586 19.42586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.02506 6.22506 7.42506 8.82506 11.02506 12.22506 13.42506 14.62506 15.82506 17.02506 18.22506 19.42506	-0.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 11.82500 12.22500 13.42500 14.62500 14.82500 15.82500 17.82500 18.22500 19.42500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.82586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 18.22586 19.42586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 17.82506 19.42506	-8.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500 11.82500 12.22500 13.42500 14.62500 17.82500 18.22500 18.22500 18.22500
Riser Line	2 3 4 6 7 9 18 11 12 13 14 15 16 17 18	-6.97586 6.22586 1.42586 2.82586 3.82586 6.22586 7.42586 8.62586 11.82586 11.82586 14.62586 15.82586 17.82586 18.22586 19.42586	-8.97588 6.22588 1.42588 2.62588 5.82588 6.22588 7.42588 8.62588 11.82588 11.82588 12.22588 13.42588 14.62588 15.82588 17.82588 18.22588	-6.97586 6.22586 1.42586 2.62586 3.82586 6.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 18.22586 19.42586 29.62586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 15.82506 17.82506 18.22506 19.42506 28.62506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586 18.22586 19.42586 28.62586	-6.97566 6.22566 1.42586 2.62566 3.82566 5.82566 6.22566 7.42566 8.62566 11.82566 12.22566 13.42566 14.62566 15.82566 17.82566 18.22566 19.42566 28.62566	-0.97500 6.22500 1.42500 2.02500 3.82500 5.82500 7.42500 8.02500 11.82500 12.22500 13.42500 14.62500 15.82500 17.82500 18.22500 18.22500 19.42500 28.62500	-6.97586 6.22586 1.42586 2.62586 3.82586 5.82586 6.22586 7.42586 8.62586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586 18.22588 19.42586 28.62586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42566 8.62506 11.82506 12.22506 13.42506 14.62506 15.82506 17.82506 18.22506 19.42506 20.62506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 9.82500 11.82500 12.22500 13.42500 14.62500 15.82500 17.82500 18.22500 18.22500 19.42500 20.62500
Riser Line	2 3 4 6 7 9 18 11 12 13 14 15 16 17 18 19 28	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 15.82586 17.82586 18.22586 18.22586	-8.97588 6.22588 1.42588 2.62588 3.82588 6.22588 7.42588 8.62588 9.82588 11.92588 12.22588 14.62588 15.82588 17.92588 18.22588 19.42588 29.62588 21.82588	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586 18.22586 19.42586 29.62586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.92506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 19.42506 28.62506 29.62506 21.82506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586 18.22586 19.42586 28.62586 21.82586	-6.97566 6.22566 1.42586 2.62566 3.82566 6.22566 7.42566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566 17.82566 18.22566 19.42566 28.62566 21.82566	-0.97586 6.22586 1.42586 2.82586 5.82586 6.22586 7.42586 8.62586 11.82586 11.82586 12.22586 13.42586 14.62586 17.82586 18.22586 18.22586 28.62586 21.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 20.62586 21.82586	-6.97506 6.22506 1.42506 2.82506 3.82506 6.22506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 17.82506 19.42506 20.62506 21.82506	-8.97500 6.22500 1.42500 2.62500 3.82500 6.22500 7.42500 8.62500 11.82500 11.82500 11.82500 11.82500 11.82500 11.82500 11.82500 11.82500 11.82500 12.82500 12.82500 21.82500
Riser Line	2 3 4 5 6 7 9 10 11 2 13 14 15 16 17 19 20 21	-0.97586 6.22586 1.42586 2.62586 6.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 18.22586 19.42586 28.62586 28.62586 23.82586	-0.97500 0.22500 1.42500 2.62500 3.82500 5.82500 6.22500 8.62500 9.82500 11.92500 12.22500 14.62500 14.62500 17.92500 18.22500 19.42500 29.62500 23.82500 23.82500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 8.62586 9.82586 11.82586 12.22586 14.62586 17.82586 18.22586 19.42586 29.62586 21.82586 23.82586	-6.97506 8.22506 1.42506 2.62506 3.82500 6.22506 7.42506 8.62500 9.82500 11.82500 12.22500 14.62500 17.82500 17.82500 19.42500 25.62500 21.82500 23.82500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 17.82586 19.42586 29.62586 21.82586 21.82586	-6.97566 6.22566 1.42566 2.62566 3.82566 6.22566 6.22566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566 17.82566 17.82566 19.42566 28.62566 21.82566	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 17.82586 17.82586 28.62586 29.42586 21.82586 21.82586 23.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 29.62586 21.82586	-6.97506 6.22506 1.42506 2.52506 3.82500 6.22500 7.42506 8.62500 9.82500 11.82500 12.22500 14.62500 14.62500 17.82500 17.82500 18.22500 19.42500 20.62500 21.82500 23.82500	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 6.22500 7.42500 9.82500 11.82500 12.22500 14.62500 14.62500 17.82500 17.82500 18.22500 19.42500 28.62500 29.62500 21.82500 23.62500
Riser Line	2 3 4 6 7 9 18 11 12 13 14 15 16 17 18 19 28	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 15.82586 17.82586 18.22586 18.22586	-8.97588 6.22588 1.42588 2.62588 3.82588 6.22588 7.42588 8.62588 9.82588 11.92588 12.22588 14.62588 15.82588 17.92588 18.22588 19.42588 29.62588 21.82588	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 15.82586 17.82586 18.22586 19.42586 29.62586	-6.97506 6.22506 1.42506 2.62506 3.82506 5.92506 7.42506 8.62506 9.82506 11.82506 12.22506 13.42506 14.62506 17.82506 19.42506 28.62506 29.62506 21.82506	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 11.82586 12.22586 14.62586 14.62586 17.82586 19.42586 21.82586 21.82586 22.5868 24.22586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 7.42506 8.82506 9.82506 11.02506 12.22506 13.42506 14.62506 15.82506 17.02506 18.22506 19.42506 20.82506 21.82506 23.82506 24.22506	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 21.82586 21.82586 21.82586 21.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 21.82586 21.82586 23.82586 24.22586	-6.97506 6.22506 1.42506 2.52506 3.82506 6.22506 7.42506 8.62506 9.82506 11.02506 12.22506 13.42506 14.62506 17.02506 19.42506 19.42506 20.62506 21.82506 23.82506 24.22506	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 6.22500 7.42500 9.82500 11.62500 12.22500 13.42500 14.62500 17.62500 17.62500 19.42500 29.62500 21.82500 21.82500 23.62500 24.22500
Riser Line	23456789111213145161718922122	-6.97586 6.22586 1.42586 2.82586 6.82586 6.22586 7.42586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 17.82586 19.42586 28.62586 21.82586 21.82586 21.82586 24.22586	-8.97506 8.22506 1.42506 2.62506 3.82500 6.22500 6.22500 8.62500 9.82500 11.92500 12.22500 13.42500 14.62500 17.92500 18.22500 19.42500 21.82500 21.82500 23.82500 24.22500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 29.62586 23.82586 24.22586	-6.97506 6.22506 1.42506 2.62506 3.82506 6.22506 7.42506 8.62500 9.82506 11.82506 12.22500 13.42506 14.62506 17.82506 17.82506 19.42506 29.42506 21.82506 23.82506 24.22500	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 6.22586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 17.82586 19.42586 29.62586 21.82586 21.82586	-6.97566 6.22566 1.42566 2.62566 3.82566 6.22566 6.22566 8.62566 9.82566 11.82566 12.22566 13.42566 14.62566 17.82566 17.82566 19.42566 28.62566 21.82566	-0.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 14.62586 14.62586 17.82586 17.82586 17.82586 28.62586 29.42586 21.82586 21.82586 23.82586	-6.97586 6.22586 1.42586 2.62586 3.82586 6.22586 7.42586 8.62586 9.82586 11.82586 12.22586 13.42586 14.62586 17.82586 17.82586 19.42586 29.62586 21.82586	-6.97506 6.22506 1.42506 2.52506 3.82500 6.22500 7.42506 8.62500 9.82500 11.82500 12.22500 14.62500 14.62500 17.82500 17.82500 18.22500 19.42500 20.62500 21.82500 23.82500	-6.97500 6.22500 1.42500 2.62500 3.82500 6.22500 6.22500 7.42500 9.82500 11.82500 12.22500 14.62500 14.62500 17.82500 17.82500 18.22500 19.42500 28.62500 29.62500 21.82500 23.62500

TABLE 5.3-15, THETA (FRONTAL ANGLE YZ PLANE), deg

		1	2	3	4	6	6	7	•	9	16
	1	-6.24641	-6.26848	-6.27382	-6.28666	-6.29896	-6.31854	-6 .32158	-6.33197	-6.34177	-6.35896
	2	-6.24644	-6.26643	-0.27386	-6.28676	-6.29894	-6.31658	-6.32161	-6.33262	-6.34181	-6.35699
•	3	-6.24637	-0.26636	-6.27377	-6.28661	-6.29885	-6.31649	-6.32151	-6.33192	-6.34171	-0.35089
8	4	-6.24618	-6.26016	-6.27367	-6.28646	-6.29863	-6.31626	-6.32127	-6.33167	-6.34146	-0.35663
	5	-6.24689	-6.25985	-6.27325	-6.28666	-6.29828	-6.36989	-6.32589	-6.33128	-6.34166	-0.35022
ñ	6	-6.24649	-6.25943	-6.27281	-6.28586	-6.29786	-6.38939	-0.32037	-0.33075	-6.34658	-0.34966
Line	7 8	-6.24499	-6.25896	-6.27224	-6.28501	-6.29718	-6.36875	-6.31971	-6.33666	-6.33986	-6.34893
Ä	9	-0.24438	-6.25825	-6.27158	-6.28436	-6.29644	-0.36798	-6.31891	-0.32924	-6.33895	-0.34865
	19	-0.24365 -0.24283	-6.25749 -6.25862	-6.27 5 76 -6.269 6 4	-6.28346 -6.28256	-6.29556	-6.36767	-8.31797	-6.32827	-6.33795	-6.34763
er	11	-6.24189	-6 .25583	-6.26886	-6.28141	-6.29466 -6.29343	-6.36663 -6.36485	-6.31689	-6.32715	-6.33686	-6.34685
U	12	-6.24686	-6 .25453	-6.26765	-6.28626	-6.29217	-0.30354	-6.31567	-6.32589	-6.33551	-8.34452
Ri	13	-6.23971	-6.25332	-6.26638	-6.27887	-6.29678	-0.30310	-6.31432 -8.31282	-6.32449	-6.33467	-6.34364
	14	-6.23846	-6.252 96	-6.26499	- 6 .27741	-6.28926	-6.36652	-6.31119	-6.32296 -6.32126	-6.33248 -6.33674	-6.34141
ö	15	-6.23716	-6.25668	-6.26348	-6.27583	-6.28761	-6.29881	-6.36942	-6.31944	-6.32886	-0.33962 -0.33769
÷	16	-6.23564	-6.24962	-6.26186	-0.27414	-6.28584	-6.29697	-6.30752	-6.31747	-6.32684	-8.33562
panwise	17	-0.23468	-6.24737	-6.26612	-6.27232	-6.28395	-6.29588	-6.36548	- 6 .31537	-6.32467	- 0 .33339
덡	18	-6.23241	-6.24681	-6.25827	-0.27638	-6.28193	-6.29296	-6.30336	-6.31312	-6.32236	-0.3333
ă	19	-6.23665	-6.24374	-0.25831	-6.26832	-0.27978	-6.29668	-6.30100	-0.31074	-0.31991	-6.3286 8
S	29	-6.22878	-6.24177	-6.25423	-6.26615	-6.27752	-6.28832	-6.29856	-6.36822	-6.31732	-6.32584
	21	-Ø.22681	-6.23969	-6.25264	-8.26386	-0.27513	-6.28584	-6.29599	-0.30557	-6.31459	-6.32363
	22	-6.22474	-6.23756	-6.24974	-6.26145	-6.27262	-Ø.28323	-6.29329	-6.30278	-6.31172	-6.32669
	23	-6.22257	-6.23521	-6.24734	-6.25893	-8.26999	-6.28866	-6.29646	-6.29987	-6.30871	-6.31766
	24	-6.22631	-6.23282	-6.24482	-6.25836	-6.26724	-0.27765	-6.28751	-0.29681	-0.36657	-6.31378
			- 120220					0.00.00			0.030.0
		11	12	13	14	15	16	17	18	19	28
	•										
	1	-6 .35961	-6 .36748	-6.37484	-6.38162	-6.38783	-0.39347	-6.39856	-6.46312	-6.46716	-0.41871
	2	-6.35951 -6.35966	-6.36748 -6.36753	-6.37484 -6.37489	-6.38162 -6.38167	-6.38783 -6.38788	-0.39347 -0.39352	-0.39856 -0.39861	-6.46312 -6.46318	-8.48716 -8.48722	-0.41671 -6.41677
		-6.35966 -6.35945									
:	2	-6.35966 -6.35945 -6.35919	-0.36753 -0.36742 -8.36714	-6.37469	-6.38167 -6.38166 -6.38128	-0.38788 -0.38776 -0.38747	-0.39352	-6 .39861	-6.46318	-6.46722	-8.41877
No.	2 3 4 5	-6.35966 -6.35945 -6.35919 -6.35877	-0.36763 -0.36742 -0.36714 -0.36671	-6.37469 -6.37478 -6.37458 -6.37466	-6.38167 -6.38166 -6.38128 -6.38683	-0.38788 -6.38778 -0.38747 -6.38762	-0.39352 -0.39340 -0.39311 -0.39265	-6.39861 -6.39849 -6.39826 -6.39773	-0.46318 -0.46365 -0.46276 -0.46228	-6.48722 -6.48718	-8.41877 -8.41864
No.	2 3 4 5	-6.35946 -6.35946 -6.35919 -6.35877 -6.35818	-6.36763 -6.36742 -6.36714 -6.36671 -6.36612	-6.37489 -6.37478 -6.37458 -6.37466 -6.37346	-6.38167 -6.38166 -6.38128 -6.38663 -6.38621	-6.38788 -6.38776 -6.38747 -6.38762 -6.38639	-0.39352 -0.39346 -0.39311 -6.39265 -0.39261	-6.39861 -6.39849 -6.39825 -6.39773 -6.39769	-6.46318 -6.46365 -6.46276	-6.48722 -6.48716 -6.46688	-8.41877 -8.41864 -8.41834
	2 3 4 6 6 7	-6.35966 -6.35945 -6.35919 -6.35877 -6.35818 -6.35746	-6.36763 -6.36742 -6.36714 -6.36671 -6.36612 -6.36636	-6.37469 -6.37478 -6.37456 -6.37466 -6.37346	-6.38167 -6.38156 -6.38128 -6.38683 -6.38621 -6.37943	-0.38788 -0.38776 -0.38747 -0.38702 -0.38639 -0.38659	-0.39352 -0.39340 -0.39311 -0.39265 -0.39201 -6.39120	-6.39849 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627	-6.46318 -6.46365 -6.46276 -6.46228 -6.46163 -6.46686	-6.46722 -6.46718 -6.46688 -6.46632 -6.46586 -6.46482	-8.41877 -8.41864 -8.41834 -6.48985 -8.46919 -6.46835
	2 3 4 5 6 7	-6.35966 -6.35945 -6.35919 -6.35877 -6.35818 -6.35745 -6.35665	-0.36753 -0.36742 -0.36714 -0.36671 -0.36612 -0.36636 -0.36446	-6.37489 -6.37478 -6.37456 -6.37466 -6.37346 -6.37269 -6.37176	-6.38167 -6.38156 -6.38128 -6.38683 -6.38621 -6.37943 -6.37848	-0.38788 -0.38776 -0.38747 -0.38702 -0.38639 -0.38659 -0.38463	-0.39352 -0.39348 -0.39311 -0.39265 -0.39281 -0.39128 -0.39622	-6.39861 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627 -6.39627	-6.46318 -6.46366 -6.46276 -6.46228 -6.46163 -6.46686 -6.39986	-6.48722 -6.48718 -6.48688 -6.48632 -6.48586 -6.48482 -6.48381	-8.41877 -8.41864 -8.41834 -8.48985 -8.48919 -8.48835 -8.48733
Line No.	2 3 4 6 6 7 8	-6.35966 -6.35945 -6.35919 -6.35877 -6.35818 -6.35745 -6.35656	-6.36753 -6.36742 -6.36714 -6.36671 -6.36612 -6.36536 -6.36445 -6.36337	-6.37489 -6.37478 -6.37456 -6.37466 -6.37269 -6.37176 -6.37866	-6.38167 -6.38156 -6.38128 -6.38683 -6.38621 -6.37943 -6.37736	-6.38788 -6.38776 -6.38747 -6.38762 -6.38639 -6.38659 -6.38463 -6.38349	-6.39352 -6.39346 -6.39311 -6.39265 -6.39281 -6.39126 -6.39622 -6.38967	-6.39861 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627 -6.39627 -6.39411	-0.46318 -0.46365 -0.46276 -0.46228 -0.46163 -0.46686 -0.39986 -0.39862	-6.46722 -6.46718 -6.46688 -6.46632 -6.46566 -6.46482 -6.46381 -6.46262	-8.41877 -8.41864 -8.41834 -8.4898 -8.48919 -8.48835 -8.48733 -8.48612
Line	2 3 4 5 6 7 8	-6.35956 -6.35945 -6.35919 -6.35877 -6.35745 -6.35745 -6.35556 -6.35556	-6.36763 -6.36742 -6.36714 -6.36671 -6.36612 -6.36445 -6.36337 -6.36214	-6.37469 -6.37478 -6.37466 -6.37366 -6.37269 -6.37175 -6.37866 -6.36946	-6.38167 -6.38156 -6.38128 -6.38683 -6.38683 -6.37943 -6.37943 -6.37736	-6.38788 -6.38776 -6.38747 -6.38762 -6.38659 -6.38463 -6.38349 -6.38219	-6.39362 -6.39311 -6.39265 -6.39261 -6.39126 -6.39622 -6.38967 -6.38775	-6.39849 -6.39849 -6.39825 -6.39773 -6.39769 -6.39627 -6.39627 -6.39411 -6.39277	-0.46318 -6.46365 -6.46276 -6.4628 -6.46163 -6.3986 -6.39862 -6.39727	-0.48722 -0.48710 -0.48680 -0.48632 -0.48586 -0.48482 -0.48381 -0.48262 -0.48262	-8.41877 -8.41864 -8.41834 -8.48986 -8.48919 -8.48835 -8.48733 -8.48612 -8.48475
Line	2 3 4 6 6 7 9 10 11	-6.35956 -6.35945 -6.35919 -6.35877 -6.35818 -6.35745 -6.35556 -6.35556 -6.35529	-6.36763 -6.36742 -6.36714 -6.36671 -6.36636 -6.36446 -6.36337 -6.36214 -6.36675	-6.37489 -6.37478 -6.37466 -6.37346 -6.37269 -6.37175 -6.37866 -6.36948 -6.36798	-6.38167 -6.38156 -6.38128 -6.38683 -6.38621 -6.37943 -6.37736 -6.37688 -6.37668	-6.3878 -6.38776 -6.38747 -6.38762 -6.38659 -6.38463 -6.38349 -6.38219 -6.38672	-6.39362 -6.39311 -6.39265 -6.39261 -6.39261 -6.39622 -6.38967 -6.38775 -6.38625	-6.39849 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627 -6.39527 -6.39411 -6.39277 -6.39126	-0.46318 -0.46365 -0.46276 -0.46228 -0.46163 -0.39986 -0.39986 -0.39862 -6.39727 -6.39574	-0.48722 -6.48718 -6.48688 -6.48632 -6.48656 -6.48482 -6.48381 -6.48262 -6.48125 -6.39971	-8.41877 -8.41864 -6.41834 -6.48986 -8.48919 -8.48835 -8.48733 -8.48612 -8.48475 -6.48319
Line	2 3 4 5 6 7 9 10 11 12	-6.35966 -6.35919 -6.35877 -6.35818 -6.35746 -6.35666 -6.35566 -6.35569 -6.35293 -6.35141	-0.36763 -0.36742 -0.36714 -0.36671 -0.36636 -0.36436 -0.36337 -0.363214 -0.36675 -0.35920	-6.37469 -6.37478 -6.37466 -6.37346 -6.37269 -6.37175 -6.37666 -6.36948 -6.36798 -6.36648	-6.38167 -6.38156 -6.38128 -6.38583 -6.385821 -6.37943 -6.37736 -6.37736 -6.37668 -6.37463 -6.37362	-6.3878 -6.38776 -6.38747 -6.38762 -6.38659 -6.38463 -6.38349 -6.38219 -6.38672 -6.37969	-0.39352 -0.39340 -0.39311 -0.39265 -0.39261 -0.39120 -0.39622 -0.38967 -0.38775 -0.38625 -0.38466	-6.39861 -6.39849 -6.39825 -6.39773 -6.39769 -6.39627 -6.39411 -6.39277 -6.39126 -6.38968	-0.46318 -0.46365 -0.46276 -0.46228 -0.46163 -0.39986 -0.3986 -0.39862 -0.39727 -0.39574 -0.39464	-0.48722 -6.48718 -6.48688 -6.48632 -6.48686 -6.48482 -6.48381 -6.48262 -6.48125 -6.39971 -6.39799	-8.41877 -8.41864 -8.41834 -6.48985 -8.48919 -8.48835 -8.46733 -8.46612 -8.46475 -6.46319 -8.46145
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Riser Line	2 3 4 6 6 7 8 10 11 12 13 14	-6.35966 -6.35946 -6.35919 -6.35818 -6.35746 -6.35656 -6.35566 -6.35429 -6.35141 -6.34974 -6.34792	-0.36763 -0.36742 -0.36714 -0.36612 -0.36636 -0.36445 -0.36337 -0.36214 -0.36920 -0.36749 -0.36562	-6.37489 -6.37478 -6.37458 -6.37456 -6.37269 -6.37175 -6.37566 -6.36948 -6.36465 -6.36465 -6.36275	-6.38167 -6.38128 -6.38128 -6.38683 -6.37943 -6.37736 -6.37668 -6.37368 -6.37362 -6.37362 -6.37362	-6.38788 -6.38776 -6.38747 -6.38749 -6.38659 -6.38659 -6.38463 -6.38349 -6.38672 -6.37969 -6.37728 -6.37728	-0.39352 -0.39346 -0.39311 -0.39261 -0.39281 -0.39622 -0.3867 -0.3867 -0.3867 -0.38677 -0.38677	-6.39849 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627 -6.39627 -6.39411 -6.39277 -6.38968 -6.38772 -6.38576	-0.46318 -6.46365 -6.46278 -6.46228 -6.46163 -6.39986 -6.39986 -6.39987 -6.39484 -6.39216 -6.39216 -6.39612	-0.48722 -6.48718 -6.48688 -6.48682 -6.48682 -6.48482 -6.48482 -6.48262 -6.48125 -6.39979 -6.39799 -6.39483	-8.41877 -8.41864 -6.41834 -6.48985 -8.48919 -6.48835 -8.48612 -8.48612 -6.48475 -6.48475 -6.48345 -8.39965 -8.39965
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Riser Line	2 3 4 5 6 7 9 10 11 12 13 14 15 16	-6.35966 -6.35919 -6.35919 -6.35877 -6.35888 -6.35745 -6.35656 -6.35556 -6.35529 -6.35293 -6.3429 -6.34944 -6.34792 -6.34594 -6.34381	-6.36763 -6.36742 -6.36714 -6.36671 -6.36536 -6.36446 -6.36337 -6.36214 -6.36675 -6.36520 -6.36562 -6.36562 -6.36562 -6.36562	-6.37489 -6.37478 -6.37466 -6.37466 -6.37269 -6.37175 -6.37966 -6.36946 -6.36648 -6.36466 -6.36275 -6.36869 -6.36869	-6.38167 -6.38166 -6.38128 -6.38683 -6.37943 -6.37736 -6.37668 -6.37463 -6.37125 -6.36931 -6.36931 -6.36951	-6.38788 -6.38776 -6.38747 -6.38749 -6.38659 -6.38463 -6.38349 -6.38219 -6.38672 -6.37728 -6.37728 -6.37531 -6.37688	-0.39352 -0.39346 -0.39311 -0.39261 -0.39261 -0.39622 -0.38967 -0.38625 -0.38427 -0.38677 -0.37861 -0.37628	-6.39861 -6.39849 -6.39826 -6.39773 -6.39627 -6.39627 -6.39627 -6.39126 -6.38576 -6.38576 -6.38576 -6.38576 -6.38515	-0.46318 -6.46365 -6.46276 -6.46226 -6.46163 -6.39986 -6.39986 -6.399874 -6.39484 -6.39612 -6.38796 -6.38551	-0.48722 -0.48718 -0.48688 -0.48685 -0.48685 -0.48381 -0.48262 -0.48262 -0.39971 -0.39799 -0.3918 -0.3918 -0.39179 -0.39483	-8.41877 -8.41864 -8.41834 -8.48919 -8.48919 -8.48733 -8.48612 -8.48475 -8.48319 -8.48145 -8.39965 -8.39746 -8.39746 -8.39528 -8.39528
Riser Line	2 3 4 6 6 7 9 10 11 12 13 14 15 16 17	-6.35956 -6.35919 -6.35919 -6.35877 -6.35878 -6.35745 -6.35656 -6.35556 -6.35293 -6.35141 -6.34794 -6.34594 -6.34594 -6.34594 -6.345381 -6.345381	-6.36763 -6.36742 -6.36714 -6.36671 -6.36636 -6.36445 -6.3637 -6.36675 -6.36749 -6.35366 -6.35366 -6.35366 -6.35366	-6.37489 -6.37478 -6.37466 -6.37269 -6.37175 -6.37866 -6.36798 -6.36648 -6.36648 -6.36669 -6.36847 -6.3689	-6.38167 -6.38128 -6.38128 -6.38683 -6.38681 -6.37943 -6.37736 -6.37668 -6.37463 -6.37125 -6.36931 -6.36931 -6.36495 -6.36253	-6.38788 -6.38776 -6.38776 -6.38762 -6.38659 -6.38559 -6.38463 -6.3849 -6.38672 -6.3769 -6.37531 -6.37688 -6.37688	-6.39352 -6.39311 -6.39265 -6.39261 -6.39622 -6.38967 -6.38625 -6.38466 -6.38277 -6.37861 -6.37628 -6.37378	-6.39861 -6.39849 -6.39826 -6.39773 -6.39769 -6.39627 -6.39527 -6.39126 -6.38576 -6.38351 -6.38351 -6.38115 -6.37862	-0.46318 -0.46365 -0.46276 -0.4628 -0.46163 -0.3986 -0.39862 -0.398727 -6.39574 -6.39484 -6.39216 -6.38796 -6.38796 -6.38295	-0.48722 -0.48718 -0.48688 -0.48682 -0.48682 -0.48482 -0.46381 -0.46262 -0.39971 -0.39799 -0.39483 -0.39483 -0.39179 -0.38938 -0.38688	-8.41877 -8.41864 -8.41834 -8.48915 -8.48935 -8.48635 -8.48612 -8.48612 -8.48475 -8.48319 -8.48145 -8.39955 -8.39746 -8.39746 -8.39628 -8.39628
Riser Line	2 3 4 6 6 7 9 10 11 12 13 14 15 16 17 18	-6.35966 -6.35945 -6.35919 -6.35818 -6.35845 -6.35856 -6.35556 -6.35293 -6.35141 -6.34974 -6.34593 -6.34593 -6.34593 -6.34593	-6.36763 -6.36742 -6.36714 -6.36612 -6.36636 -6.36445 -6.36375 -6.36675 -6.36520 -6.35562 -6.353642 -6.353642 -6.353642 -6.34969 -6.34969 -6.34961	-6.37489 -6.37478 -6.37468 -6.37269 -6.37176 -6.37966 -6.36798 -6.36798 -6.36465 -6.36275 -6.36847 -6.35889 -6.35889	-6.38167 -6.38128 -6.38128 -6.38683 -6.38621 -6.37736 -6.37736 -6.37463 -6.37463 -6.37463 -6.37463 -6.37463 -6.36253 -6.36253 -6.36253 -6.36253 -6.36253	-6.3878 -6.38776 -6.38772 -6.38639 -6.38659 -6.38463 -6.3849 -6.38672 -6.37728 -6.37531 -6.37688 -6.36842 -6.36886	-0.39352 -0.39346 -0.39311 -0.39265 -0.39261 -0.39126 -0.3867 -0.3867 -0.38625 -0.38626 -0.38677 -0.37861 -0.37868 -0.37378 -0.37378	-6.39861 -6.39849 -6.39849 -6.39773 -6.39769 -6.39627 -6.39627 -6.39126 -6.38958 -6.38772 -6.38576 -6.38351 -6.37862 -6.37862 -6.37862 -6.37862	-0.46318 -0.46365 -0.46276 -0.46286 -0.46086 -0.39986 -0.39862 -0.39674 -6.39612 -6.39612 -6.38561 -6.38295 -6.38623	-0.40722 -0.40710 -0.40680 -0.406832 -0.40586 -0.40482 -0.40381 -0.40262 -0.40125 -0.3979 -0.3979 -0.39610 -0.39403 -0.39179 -0.38680 -0.38680 -0.38680 -0.38680	-8.41877 -8.41864 -8.41834 -8.48985 -8.48835 -9.48612 -9.48612 -8.48612 -8.48616 -8.3955 -8.39746 -8.3955 -8.39746 -9.3965 -8.39727 -8.39816 -8.38739
Riser Line	2 3 4 6 6 7 8 9 10 11 12 13 14 15 16 17 18	-6.35966 -6.35919 -6.35818 -6.35745 -6.35856 -6.35556 -6.35556 -6.35293 -6.35141 -6.34792 -6.34384 -6.34153 -6.33916 -6.33916	-6.36763 -6.36742 -6.36714 -6.36612 -6.36636 -6.36445 -6.36337 -6.36926 -6.35749 -6.35749 -6.35562 -6.35142 -6.34969 -6.34969 -6.34397	-6.37489 -6.37478 -6.37466 -6.37269 -6.37176 -6.37666 -6.36946 -6.36646 -6.36669 -6.35869 -6.35869 -6.35869	-6.38167 -6.38128 -6.38128 -6.38683 -6.37943 -6.37736 -6.37736 -6.37463 -6.37362 -6.37362 -6.37362 -6.37362 -6.36253 -6.36253 -6.36253 -6.36253 -6.36253 -6.36253 -6.36253	-6.38788 -6.38776 -6.38747 -6.38639 -6.38659 -6.38659 -6.38849 -6.38672 -6.37728 -6.37631 -6.37631 -6.37688 -6.36888 -6.36888 -6.36888	-0.39352 -0.39346 -0.39311 -0.39261 -0.39261 -0.39622 -0.38467 -0.38466 -0.38277 -0.38677 -0.37661 -0.37678 -0.37638	-6.39861 -6.39849 -6.39849 -6.39827 -6.39769 -6.39627 -6.39527 -6.39126 -6.38958 -6.38958 -6.3876 -6.38115 -6.3815 -6.38156 -6.38156 -6.3876	-0.40318 -0.40305 -0.40278 -0.40163 -0.40686 -0.39862 -0.39577 -0.39574 -0.39464 -0.39464 -0.39464 -0.38463 -0.38551 -0.38551 -0.38623 -0.37734	-0.48722 -0.48718 -0.48688 -0.48686 -0.48482 -0.48381 -0.46262 -0.48125 -0.39971 -0.39618 -0.39483 -0.39179 -0.38688 -0.38688 -0.38464 -0.38112	-8.41877 -8.41864 -6.41834 -6.48985 -8.48919 -6.46835 -9.46612 -9.46612 -9.46475 -6.46319 -8.46145 -9.3965 -6.39746 -9.3965 -6.39746 -9.39616 -6.38739 -6.38739
iser Line	2 3 4 6 6 7 8 9 10 11 12 13 14 15 17 18 19 20	-6.35966 -6.35919 -6.35818 -6.35745 -6.35656 -6.35666 -6.35429 -6.35141 -6.34974 -6.34984 -6.34153 -6.33652 -6.33652 -6.33652	-0.36763 -0.36742 -0.36714 -0.36612 -0.36636 -0.36445 -0.36337 -0.36920 -0.36749 -0.36562 -0.35360 -0.3490 -0.3490 -0.3490 -0.3490 -0.3490 -0.3490 -0.3490 -0.3490 -0.3490	-6.37489 -6.37478 -6.37468 -6.37466 -6.37269 -6.37176 -6.36948 -6.36466 -6.36466 -6.36467 -6.35847 -6.35887 -6.35887	-6.38167 -6.38128 -6.38821 -6.38621 -6.37943 -6.37736 -6.37668 -6.37362 -6.37362 -6.37362 -6.37362 -6.36295 -6.36295 -6.36721 -6.36432	-6.38788 -6.38776 -6.38747 -6.38747 -6.38639 -6.38659 -6.38463 -6.38219 -6.37728 -6.37728 -6.37631 -6.37888 -6.36886 -6.36886	-0.39352 -0.39346 -0.39311 -0.39261 -0.39229 -0.39622 -0.38677 -0.38466 -0.38277 -0.38466 -0.38277 -0.3861 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378	-6.39861 -6.39849 -6.39849 -6.39827 -6.39769 -6.39627 -6.39627 -6.39527 -6.38968 -6.38772 -6.38576 -6.38351 -6.38115 -6.38162 -6.37593 -6.37565	-0.40318 -0.40305 -0.40278 -0.40228 -0.40086 -0.39862 -0.39577 -0.39577 -0.39484 -0.39484 -0.39612 -0.38551 -0.38551 -0.38295 -0.38796	-0.48722 -6.48718 -6.48688 -6.48682 -6.48685 -6.48482 -6.48262 -6.48125 -6.39971 -6.399618 -6.39483 -6.39179 -6.38688 -6.38688 -6.38112 -6.37884	-8.41877 -8.41834 -8.41834 -8.48919 -8.48835 -8.48612 -8.48612 -8.48612 -8.486145 -8.39965 -8.39965 -8.39746 -8.39277 -8.39628 -8.39277 -8.396333
Riser Line	2345678911123145517819921	-6.35966 -6.35946 -6.35919 -6.35818 -6.35745 -6.35656 -6.35529 -6.35293 -6.34792 -6.34792 -6.3494 -6.3494 -6.333694 -6.333692 -6.33379 -6.338992	-0.36763 -0.36742 -0.36714 -0.36671 -0.36536 -0.36445 -0.36337 -0.36214 -0.36975 -0.35920 -0.35749 -0.35562 -0.35360 -0.3542 -0.34909 -0.34811 -0.34397 -0.343119 -0.33825	-6.37489 -6.37478 -6.37458 -6.37456 -6.37269 -6.37175 -6.36946 -6.36946 -6.36465 -6.36275 -6.3689 -6.35889 -6.35889 -6.35889 -6.35889 -6.35889 -6.35887 -6.35889	-6.38167 -6.38166 -6.38128 -6.38821 -6.37943 -6.37948 -6.37668 -6.37469 -6.37469 -6.36931 -6.36495 -6.36495 -6.3653 -6.3653 -6.35721 -6.35432 -6.35432 -6.35432	-6.38788 -6.38776 -6.38747 -6.38747 -6.38639 -6.38659 -6.38463 -6.3849 -6.38672 -6.37728 -6.37631 -6.37688 -6.368842 -6.36882 -6.36888 -6.36888 -6.36888	-0.39352 -0.39346 -0.39311 -0.39261 -0.39281 -0.39622 -0.38675 -0.38626 -0.38277 -0.38677 -0.38677 -0.37628 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378	-6.39861 -6.39849 -6.39827 -6.39779 -6.39627 -6.39627 -6.39411 -6.39277 -6.38968 -6.38772 -6.38576 -6.38515 -6.37585 -6.37585 -6.375865 -6.376866	-0.40318 -0.40305 -0.40278 -0.40228 -0.40686 -0.39862 -0.39862 -0.3944 -0.3944 -0.39216 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651 -0.38651	-0.48722 -6.48718 -6.48688 -6.48682 -6.48482 -6.48482 -6.48262 -6.48125 -6.39971 -6.39719 -6.39463 -6.39463 -6.38464 -6.38484 -6.38484 -6.38484	-8.41877 -8.41834 -6.41834 -6.48985 -8.48919 -6.48835 -8.48612 -8.48612 -8.48612 -8.48614 -8.39965 -8.39965 -8.39746 -8.39965 -8.39277 -8.39816 -8.38444 -6.38133 -6.37865
Riser Line	2 3 4 5 6 7 8 9 10 11 12 3 14 15 16 17 18 19 21 22	-6.35966 -6.35919 -6.35919 -6.35877 -6.35888 -6.35745 -6.35656 -6.35556 -6.35529 -6.35293 -6.3429 -6.34792 -6.34792 -6.34594 -6.343918 -6.33379 -6.33379 -6.332796	-0.36763 -0.36742 -0.36714 -0.36671 -0.36536 -0.36446 -0.36337 -0.36214 -0.36562 -0.35749 -0.35562 -0.35360 -0.34360 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367 -0.34367	-6.37489 -6.37478 -6.37468 -6.37466 -6.37269 -6.37175 -6.37966 -6.36948 -6.36465 -6.36465 -6.36275 -6.36869 -6.35869 -6.35869 -6.35869 -6.35869 -6.35863 -6.34863 -6.34863 -6.34863	-6.38167 -6.38166 -6.38128 -6.38881 -6.37943 -6.37948 -6.37668 -6.37668 -6.37463 -6.37125 -6.36931 -6.36951 -6.36253 -6.36595 -6.35432 -6.35432 -6.35432 -6.35432 -6.35432 -6.35432 -6.35432 -6.35432	-6.38788 -6.38776 -6.38747 -6.38749 -6.38659 -6.38463 -6.38219 -6.38672 -6.37728 -6.37728 -6.37688 -6.36868 -6.36668 -6.36668 -6.36598	-0.39352 -0.39346 -0.39311 -0.39261 -0.39261 -0.39622 -0.38677 -0.38626 -0.38466 -0.38277 -0.37861 -0.37628 -0.37378 -0.37112 -0.36532 -0.36532 -0.36532 -0.36532	-6.39861 -6.39849 -6.39826 -6.39773 -6.39627 -6.39627 -6.39411 -6.39277 -6.3856 -6.38576 -6.38576 -6.38576 -6.37565 -6.37565 -6.37666 -6.36866 -6.36866 -6.36866	-0.40318 -0.40305 -0.40276 -0.4028 -0.40686 -0.39862 -0.39862 -0.39862 -0.39674 -0.39464 -0.39612 -0.38551 -0.38551 -0.38295 -0.38723 -0.37728 -0.37126 -0.37126 -0.36768	-0.48722 -0.48718 -0.48688 -0.48685 -0.48685 -0.48381 -0.48262 -0.48125 -0.39971 -0.3979 -0.39618 -0.39463 -0.39463 -0.38463 -0.38464 -0.38464 -0.37478 -0.37478 -0.37478	-8.41877 -8.41864 -8.41834 -8.48985 -8.48919 -8.48733 -8.48612 -8.48475 -8.48319 -8.484145 -8.39955 -8.39746 -8.39746 -8.39746 -8.39746 -8.39818 -8.38133 -8.38444 -8.38133
Riser Line	2345678911123145517819921	-6.35966 -6.35946 -6.35919 -6.35818 -6.35745 -6.35656 -6.35529 -6.35293 -6.34792 -6.34792 -6.3494 -6.3494 -6.333694 -6.333692 -6.33379 -6.338992	-0.36763 -0.36742 -0.36714 -0.36671 -0.36536 -0.36445 -0.36337 -0.36214 -0.36975 -0.35920 -0.35749 -0.35562 -0.35360 -0.3542 -0.34909 -0.34811 -0.34397 -0.343119 -0.33825	-6.37489 -6.37478 -6.37458 -6.37456 -6.37269 -6.37175 -6.36946 -6.36946 -6.36465 -6.36275 -6.3689 -6.35889 -6.35889 -6.35889 -6.35889 -6.35889 -6.35887 -6.35889	-6.38167 -6.38166 -6.38128 -6.38821 -6.37943 -6.37948 -6.37668 -6.37469 -6.37469 -6.37452 -6.36931 -6.36495 -6.36253 -6.3653 -6.35951 -6.359521 -6.35432 -6.35432 -6.35432	-6.38788 -6.38776 -6.38747 -6.38747 -6.38639 -6.38659 -6.38463 -6.3849 -6.38672 -6.37728 -6.37631 -6.37688 -6.368842 -6.36882 -6.36888 -6.36888 -6.36888	-0.39352 -0.39346 -0.39311 -0.39261 -0.39281 -0.39622 -0.38675 -0.38626 -0.38277 -0.38677 -0.38677 -0.37628 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378 -0.37378	-6.39861 -6.39849 -6.39827 -6.39779 -6.39627 -6.39627 -6.39411 -6.39277 -6.38968 -6.38772 -6.38576 -6.38515 -6.37585 -6.37585 -6.375865 -6.376866	-0.40318 -0.40305 -0.40278 -0.40228 -0.40686 -0.39862 -0.398727 -0.39474 -0.39474 -0.39612 -0.38651 -0.38651 -0.38651 -0.38651 -0.38796	-0.48722 -6.48718 -6.48688 -6.48682 -6.48482 -6.48482 -6.48262 -6.48125 -6.39971 -6.39719 -6.39463 -6.39463 -6.38464 -6.38484 -6.38484 -6.38484	-8.41877 -8.41834 -6.41834 -6.48985 -8.48919 -6.48835 -8.48612 -8.48612 -8.48612 -8.48614 -8.39965 -8.39965 -8.39746 -8.39965 -8.39277 -8.39816 -8.38444 -6.38133 -6.37865

TABLE 5.3-16, CL1 (BASED ON INDIVIDUAL REF AREA)

		1	2	3	4	6	6	7	8	9	16
	1	-6.56649	-6.86652	-6. 666 55	-6.66658	-6.56661	~6.86663	-8.66668	-8.90069	-6.98671	-6.66673
	2	-6.666 49	-6.866 52	-6.666 55	-6. 866 58	-6.66661	-6.868 64	-6.66666	-6.86669	-6.66671	-6.66673
	3	-8.866 49	-6.666 52	-6.066 55	-6 . 866 58	-6. <i>666</i> 61	-0.666 63	-6.666 66	-6.86669	-6.66671	-6.00073
S	4	-6.86649	-6.66652	-6.66655	- 6.866 58	-6.66661	- 0.666 63	-6 . 666 66	-6. <i>86</i> 668	-0.666 71	-0. <i>666</i> 73
Z	6	-8.66649	-0.00052	-6.86655	-6.66658	-6.00061	-6.66663	-6.66666	-6.66668	-6.66671	-6.66673
Q	6 7	-6.66649 -6.66649	-6.66652	-0.00055	- 6 . 566 58	-6.66661	- 6.666 63	-6.56666	-6.56668	-6.66671	-6.66673
in	8	-0.56649	-0.00052 -0.00052	-6.00065 -6.00065	-6.86658 -6.86657	-6.66666 -6.66666	-6.66663 -6.66663	-6.66666 -6.66665	-6.66668 -6.66668	-6.66676	-6.86673
Ä	9	-6.86649	-0.66652	- 6.866 54	- 6 . 866 57	-6.66666	-6.666 63	-6.00005	-0.00008	-6.66676 -6.66678	- 6.868 73 -8.868 72
ы	10	-5.86648	-0.00051	-6.00054	-6.86657	-6.00000	-6.66662	-0.00005	-6.66667	-6.66678	-6.66672
a	11	-6.96648	-6.80051	-6.66654	-6.86657	-6.86659	-6.86662	-6.66665	-6.00067	-6.66669	-8.86672
15	12	-6. 906 48	-6.66651	-6. 666 54	-6. 860 58	-8.88659	-6.66662	-6.56664	-6.66667	-6.66669	-6.86671
œ	13	-6. 866 48	-0. <i>00</i> 05 <i>6</i>	-6.866 53	- 0 . 866 58	-6.66659	-0.866 61	-6.56664	-6.66666	-6.66668	-0.66671
a	14	-6.866 47	-6.00658	-6.866 53	- 6.866 58	-6.66658	-6. <i>666</i> 61	-6. <i>866</i> 63	-6. <i>000</i> 66	-6. <i>0</i> 0068	-6.00676
C/A	15	-6.66647	-0.66656	-0.80653	-6.86655	-6.66658	-6.86661	- 6.666 63	-6. <i>000</i> 85	-6. <i>6</i> 6668	-6.86678
7	16	-8.86647	-6.86649	-6.866 52	-0.66655	-6.88657	-6.86666	-6.66662	-0.00065	-6. <i>6</i> 6667	-6.00669
panwi	17	-6.56646	-0.86649	-6. 866 52	- 6 . 866 54	-6.66667	-6.66666	-6.66662	-0.66664	-6.96667	-6.86669
ď	18 19	-0.00046 -0.00045	-6.88649 -6.88648	-6.86651 -6.86651	- 6.866 53	-6.66657 -6.66658	-6.66659 -6.66658	-6.66662 -6.66661	-6.66664	-6.66666	-6.86668
S	29	-0.00045	-0.00048	-0.00051	- 6.866 53	-6.86655	- 6.866 58	-0.88666	-0.00063 -0.00062	-0.00065 -0.00065	-6.66667 -6.66667
	21	-6. 886 45	-6.00047	-6.66656	-6.86652	-6.00055	-6.86657	-6.86666	-6.88662	-6.00005	-6.56666
	22	-8.00644	-0.00046	-6.86649	-6.86652	-0.00064	-6.66658	-6.86659	-6.00001	-6.00063	-6.00005
	23	-6.00643	-6.66646	-6.66649	-6.00061	-0.00063	-8.86658	-6.66668	-6.00066	-6.00062	-0.86664
	24	-6.866 43	-6. 866 46	-6.666 48	-6. 866 51	-6.600 53	-8. 866 55	-6.56658	-6.66666	-6.66662	-6.86664
		11	12	13	14	15	16	17	18	19	20
	1	-6.000 76	-6.66678	-6.86686	-0.86682	-6. 060 84	- 6.606 85	- 6 . 906 87	-6.66689	-6.86698	-0.66692
	2	-0.00076 -0.00076	-6.66678 -6.66678	-6.86686 -6.86686	-0.86682 -6.86682	-6.00084 -6.00084	-0.00085 -0.00685	-6.86687 -6.86687	-6.66689 -6.66689	-0.00090 -0.00090	-6.88892 -6.88892
	2	-8.86676 -8.86678 -8.86676	-6.66678 -6.66678 -6.66678	-6.86686 -6.86686 -6.86686	-0.86682 -0.86682 -6.86682	-6.00084 -6.50684 -6.50084	-6.66685 -6.66685 -6.66685	-6.66687 -6.66687 -6.66687	-6.66689 -6.66689	-6.86696 -6.66696 -6.86696	-0.88892 -0.88892 -0.88892
·	2 3 4	-6.00076 -6.00076 -6.00076 -6.00075	-6.66678 -6.66678 -6.66678	-6.86686 -6.86686 -6.86686 -6.86686	-0.86682 -6.86682 -6.86682	-6.00084 -6.00084 -6.00084 -6.00083	-0.00085 -0.00685 -0.00085	-6.86687 -6.86687 -6.66687	-6.86689 -6.86689 -6.86689	-6.86696 -6.86696 -6.86696	-6.88692 -6.88692 -6.88692 -6.88691
No.	2 3 4 6	-8.86676 -8.86676 -8.86676 -8.86675 -8.86675	-6.86678 -6.86678 -6.86678 -6.86678 -6.86677	-6.86686 -6.86686 -6.86686 -6.86686	-0.86682 -6.86682 -6.86682 -6.86682	-6.86684 -6.86684 -6.86684 -6.66683	-6.66685 -6.6685 -6.6685 -6.6685	-6.86687 -6.86687 -6.66687 -6.66687	-6.86689 -6.86689 -6.86689 -6.86689	-6.86696 -6.86696 -6.86696 -6.86696 -6.86696	-0.80092 -0.80092 -0.80092 -0.80091 -0.80091
Z	2 3 4	-6.00076 -6.00076 -6.00076 -6.00075	-6.66678 -6.66678 -6.66678	-6.86686 -6.86686 -6.86686 -6.86686	-0.86682 -6.86682 -6.86682	-6.00084 -6.00084 -6.00084 -6.00083	-0.00085 -0.00685 -0.00085	-6.86687 -6.86687 -6.66687	-6.86689 -6.86689 -6.86689 -6.86689 -6.86688	-6.866.96 -6.866.96 -6.866.96 -6.866.96 -6.866.96	-0.80092 -0.80092 -0.80092 -0.80092 -0.80091 -0.80091
Z	2 3 4 6	-0.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075	-6.60678 -6.60678 -6.60678 -6.60677 -6.60677	-6.50086 -6.50086 -6.50086 -6.50086 -6.50086	-0.86682 -6.86682 -6.86682 -6.86681 -6.86681	-6.00084 -6.50084 -6.50084 -6.60083 -6.50083	-0.00085 -0.00085 -0.00085 -0.00085 -0.00085	-6.86687 -6.86687 -6.66687 -6.66687 -6.86687 -6.86687	-6.86689 -6.86689 -6.86689 -6.86689	-6.86696 -6.86696 -6.86696 -6.86696 -6.86696	-0.80092 -0.80092 -0.80092 -0.80091 -0.80091
Z	2 3 4 6 6 7	-0.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075	-6.66678 -6.66678 -6.66678 -6.66677 -6.66677 -6.66677	-6.56686 -6.56686 -6.56686 -6.56686 -6.56679 -6.56679	-0.86682 -6.86682 -6.86682 -6.86681 -6.86681	-6.00084 -6.50084 -6.50084 -6.00083 -6.50083 -6.50083	-0.00085 -0.00085 -0.00085 -0.00085 -0.00085 -0.00085	-6.86687 -6.86687 -6.66687 -6.86687 -6.86687 -6.86687 -6.86686	-6.86689 -6.86689 -6.86689 -6.86689 -6.86688 -6.86688	-6.86696 -6.86696 -6.86696 -6.86696 -6.86696 -6.86696 -6.86689	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091
Line N	2 3 4 6 6 7 8 9	-6.80076 -0.80076 -0.80076 -0.80075 -0.80075 -0.80075 -0.80075 -0.80075 -0.80074	-6.86678 -6.86678 -6.86678 -6.86677 -6.86677 -6.86677 -6.86677 -6.86677 -6.86677	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86679 -6.86678	-0.56682 -6.56682 -6.56682 -6.56681 -6.56681 -6.56681 -6.56681 -6.56685	-6.00084 -6.50684 -6.50683 -6.50683 -6.50683 -6.50683 -6.50682 -6.50682	-6.00085 -6.50085 -6.50085 -6.50085 -6.50085 -6.50085 -6.50084 -6.50084 -6.50084	-6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086	-6.66689 -6.66689 -6.66689 -6.56688 -6.56688 -6.56688 -6.56688 -6.566887 -6.56687	-6.86696 -6.86696 -6.86696 -6.86696 -6.86696 -6.86689 -6.86689	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00091
Line N	2 3 4 6 7 8 9 10	-6.86676 -6.86676 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86674 -6.86674	-6.66678 -6.66678 -6.66678 -6.66677 -6.66677 -6.86677 -6.86677 -6.86676	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86681 -0.86681 -0.86686 -0.86686 -0.86686	-6.00084 -6.50684 -6.56683 -6.56683 -6.56683 -6.56683 -6.56682 -6.56682 -6.56682 -6.56682	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00084	-6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086	-0.60689 -0.60689 -0.50689 -0.50688 -0.50688 -0.50688 -0.50687 -0.50687 -0.50687	-6.86696 -6.86696 -6.86696 -6.86696 -6.86696 -6.86689 -6.86689 -6.86689 -6.86688 -6.86688	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090
ser Line N	2 3 4 6 6 7 8 9 10 11 12	-0.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075 -0.00075 -0.00074 -0.00074 -0.00074	-6.60678 -6.00678 -6.00678 -6.00677 -6.00677 -6.00677 -6.00677 -6.00677 -6.00676 -6.00678 -6.00676	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678	-0.86682 -6.86682 -6.66682 -6.66681 -6.86681 -6.86681 -6.86686 -6.86686 -6.86686 -6.86686 -6.86686	-6.00084 -6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00082 -6.00082 -6.00082	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00084 -6.00084	-6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086	-6.66689 -6.66689 -6.56689 -6.56688 -6.56688 -6.56687 -6.56687 -6.56685	-6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.00000 -6.000000 -6.0000 -6.	-8.88892 -6.88892 -6.88892 -6.88891 -8.88891 -6.88891 -6.88891 -6.88898 -6.88898 -6.88898 -6.88898
iser Line N	2 3 4 6 7 8 9 10 11 12 13	-6.80676 -0.80678 -0.80678 -0.80675 -0.80675 -0.80675 -0.80675 -0.80674 -0.80674 -0.80673 -0.80673	-6.80678 -6.20678 -6.80678 -6.80678 -6.80677 -6.80677 -6.80677 -6.80677 -6.80676 -6.80676 -6.80676 -6.80676	-6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678 -6.86678	-0.86682 -6.86682 -6.86682 -6.86681 -6.86681 -6.86681 -6.86686 -6.86686 -6.86686 -6.866879 -6.86679	-6.00084 -6.00684 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00082 -6.00081 -6.00081	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00083 -6.00083	-6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086	-6.66689 -6.66689 -6.56689 -6.56688 -6.56688 -6.56688 -6.56687 -6.56686	-6.66696 -6.66696 -6.66696 -6.56696 -6.66689 -6.66689 -6.66689 -6.66688 -6.66688 -6.66688 -6.66688	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00089
Riser Line N	2 3 4 6 6 7 8 9 10 11 12 13 14	-6.00076 -0.00076 -0.00075 -0.00075 -0.00075 -0.00075 -0.00075 -0.00075 -0.00073 -0.00073 -0.00073	-6.80678 -6.20678 -6.80678 -6.80677 -6.80677 -6.80677 -6.80677 -6.80677 -6.80676 -8.80676 -8.80676 -9.80675 -9.80675	-6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86677 -6.86677	-0.86682 -6.86682 -6.86682 -6.86681 -6.86681 -6.86681 -6.86681 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679	-6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00082 -6.00082 -6.00081 -6.00081	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00083 -6.00083 -6.00083	-6.00087 -6.00087 -6.00087 -6.00087 -6.50087 -6.50086 -6.00086 -6.00086 -6.00086 -6.50086 -6.50086 -6.50084	-6.60689 -6.60689 -6.60689 -6.50688 -6.60688 -6.60688 -6.60687 -6.60686 -6.60686	-6.66696 -6.66696 -6.66696 -6.56696 -6.56696 -6.66689 -6.56688 -6.56688 -6.56688 -6.56688 -6.56688	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00088 -0.00088
se Riser Line N	2 3 4 6 6 7 8 9 10 11 12 13 14 15	-6.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075 -0.00075 -0.00075 -0.00073 -0.00073 -0.00073	-6.80678 -6.80678 -6.80678 -6.80677 -6.80677 -6.80677 -6.80677 -6.80676 -6.80676 -6.80676 -6.80676	-0.80088 -0.80080 -0.80080 -0.80080 -0.80079 -0.80079 -0.80079 -0.80078 -0.80078 -0.80077 -0.80077 -0.80077	-0.86682 -6.86682 -6.86681 -6.86681 -6.86681 -6.86681 -6.86681 -6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86678	-6.00084 -6.56684 -6.56683 -6.56683 -6.56683 -6.56683 -6.56682 -6.56682 -6.56682 -6.56682 -6.56682 -6.56682 -6.56683 -6.56682	-6.00685 -6.00685 -6.00685 -6.00685 -6.00685 -6.00685 -6.00684 -6.00684 -6.00684 -6.00683 -6.00682 -6.00682 -6.00682	-6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00084 -6.00084	-6.6669 -6.6669 -6.6669 -6.5668 -6.5668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6686 -6.6685 -6.6685	-6.86696 -6.86696 -6.86696 -6.56696 -6.56696 -6.66689 -6.66689 -6.66688 -6.66688 -6.86688 -6.866887 -6.866887 -6.866887 -6.866887	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00090 -0.00090 -0.00080
se Riser Line N	2 3 4 6 7 8 9 10 11 12 13 14 15 16	-6.86676 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86674 -6.86674 -6.86673 -6.86673 -6.86673 -6.86673	-6.86678 -6.96678 -6.96678 -6.96677 -6.96677 -6.96677 -6.96677 -6.96676 -6.96676 -6.96676 -6.96674 -6.96673	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678 -6.86677 -6.86677 -6.86675 -6.86675	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86681 -0.86686 -0.86686 -0.86679 -0.86679 -0.86678 -0.86678	-6.00084 -6.50684 -6.50683 -6.50683 -6.50683 -6.50683 -6.50682 -6.50682 -6.50681 -6.60681 -6.60686 -6.50686 -6.50686	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00083 -6.00083 -6.00082 -6.00082 -6.00082	-6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00084	-0.60689 -0.60689 -0.50689 -0.50688 -0.60688 -0.60687 -0.60687 -0.60686 -0.60686 -0.60686 -0.60686	-6.66696 -6.66696 -6.66696 -6.56696 -6.56696 -6.56689 -6.66689 -6.66688 -6.66688 -6.66687 -6.56688 -6.56688	-6.00092 -6.00092 -6.00091 -6.00091 -6.00091 -6.00091 -6.00096 -6.00096 -6.00096 -6.00096 -6.00096 -6.00096 -6.00088
se Riser Line N	2 3 4 6 6 7 8 9 10 11 12 13 14 15	-6.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075 -0.00075 -0.00075 -0.00073 -0.00073 -0.00073	-6.80678 -6.80678 -6.80678 -6.80677 -6.80677 -6.80677 -6.80677 -6.80676 -6.80676 -6.80676 -6.80676	-0.80088 -0.80080 -0.80080 -0.80080 -0.80079 -0.80079 -0.80079 -0.80078 -0.80078 -0.80077 -0.80077 -0.80077	-0.86682 -6.86682 -6.86681 -6.86681 -6.86681 -6.86681 -6.86681 -6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86678	-6.00084 -6.56684 -6.56683 -6.56683 -6.56683 -6.56683 -6.56682 -6.56682 -6.56682 -6.56682 -6.56682 -6.56682 -6.56683 -6.56682	-6.00685 -6.00685 -6.00685 -6.00685 -6.00685 -6.00685 -6.00684 -6.00684 -6.00684 -6.00683 -6.00682 -6.00682 -6.00682	-6.00087 -6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00084 -6.00084	-6.6669 -6.6669 -6.6669 -6.5668 -6.5668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6686 -6.6685 -6.6685	-6.66696 -6.66696 -6.66696 -6.66689 -6.66689 -6.66689 -6.66688 -6.66688 -6.66688 -6.66687 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00090 -0.00090 -0.00080
se Riser Line N	2 3 4 6 7 8 9 10 11 12 13 14 15 16 17	-6.80676 -0.80676 -0.80676 -0.80675 -0.80675 -0.80675 -0.80675 -0.80674 -0.80673 -0.80673 -0.80673 -0.80672 -0.80671	-6.86678 -6.86678 -6.86678 -6.86677 -6.86677 -6.86677 -6.86677 -6.86676 -6.86676 -6.86676 -6.86676 -6.86676 -6.86676 -6.86673 -6.86673 -6.86673 -6.86673	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86677 -6.86677 -6.86675 -6.86675 -6.86675	-0.86682 -0.86682 -0.86682 -0.66681 -0.86681 -0.86681 -0.86681 -0.86686 -0.86689 -0.86679 -0.86679 -0.86677 -0.86677 -0.86677	-6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00081 -6.00081 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00081 -6.00081	-6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00084	-0.60689 -0.60689 -0.50689 -0.50688 -0.50688 -0.50688 -0.50688 -0.50687 -0.50687 -0.50686 -0.50686 -0.50686 -0.50686	-6.66696 -6.66696 -6.66696 -6.56696 -6.56696 -6.56689 -6.66689 -6.66688 -6.66688 -6.66687 -6.56688 -6.56688	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00090 -0.00000 -0.00000 -0.00000
e Riser Line N	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	-6.00076 -0.00076 -0.00076 -0.00076 -0.00075 -0.00075 -0.00075 -0.00077 -0.00077 -0.00077 -0.00077 -0.00077 -0.00077 -0.00079 -0.00079 -0.00079 -0.00079 -0.00079 -0.00079	-6.80678 -6.80678 -6.80678 -6.80677 -6.80677 -6.80677 -6.80677 -6.80677 -6.80676 -6.80676 -6.80676 -6.80676 -6.80673 -6.80673 -6.80672 -6.80671 -6.80671	-6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86677 -6.86677 -6.86677 -6.86675 -6.86675 -6.86674 -6.86673 -6.86673 -6.86673	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86681 -0.86686 -0.86686 -0.86679 -0.86679 -0.86678 -0.86678 -0.86677 -0.86677	-6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00082 -6.00081 -6.00086 -6.00086 -6.00086 -6.00087 -6.00078 -6.00078	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00084 -6.00083 -6.00083 -6.00082 -6.00082 -6.00081 -6.00088 -6.00088	-6.00087 -6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00084 -6.00084 -6.00084 -6.00082 -6.00082	-6.60689 -6.00689 -6.00689 -6.50688 -6.50688 -6.60687 -6.60687 -6.60686 -6.60686 -6.60686 -6.60686 -6.60683 -6.60683	-6.66696 -6.66696 -6.66696 -6.56696 -6.56689 -6.56689 -6.56688 -6.56688 -6.56687 -6.56687 -6.56687 -6.56687 -6.56687 -6.56685 -6.56685 -6.56685 -6.56685	-0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00090 -0.00080 -0.00080 -0.00080 -0.00080 -0.00080 -0.00080 -0.00080 -0.00080
se Riser Line N	2 3 4 6 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	-6.86676 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86676 -6.86674 -6.86674 -6.86673 -6.86673 -6.86671 -6.86671 -6.86671 -6.86679 -6.86679 -6.86679 -6.86679 -6.86679	-6.86678 -6.96678 -6.96678 -6.96677 -6.96677 -6.96677 -6.96677 -6.96676 -6.96676 -6.96676 -6.96676 -6.96676 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677	-6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678 -6.86677 -6.86676 -6.86675 -6.86674 -6.86674 -6.86674 -6.86673 -6.86673 -6.86673 -6.86673	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86681 -0.86686 -0.86679 -0.86679 -0.86678 -0.86678 -0.86678 -0.86678 -0.86678 -0.86678 -0.86674 -0.86674	-6.00084 -6.50684 -6.50683 -6.50683 -6.50683 -6.50682 -6.50682 -6.50682 -6.50681 -6.60681 -6.50686	-6.00685 -6.50685 -6.50685 -6.50685 -6.50685 -6.50684 -6.50684 -6.50683 -6.50683 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683	-6.00687 -6.00687 -6.00687 -6.00687 -6.00686 -6.00686 -6.00686 -6.00685 -6.00685 -6.00685 -6.00684 -6.00684 -6.00682 -6.00682 -6.00682 -6.00681 -6.00681 -6.00687 -6.00687	-6.60689 -6.60689 -6.50689 -6.50688 -6.50688 -6.50688 -6.50687 -6.50686 -6.50686 -6.50686 -6.50686 -6.50686 -6.50688	-6.66696 -6.66696 -6.66696 -6.66696 -6.66689 -6.66689 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688 -6.66688	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00089 -0.00088 -0.00088 -0.00087 -0.00087 -0.00088
se Riser Line N	2 3 4 6 7 8 9 10 11 12 13 14 15 16 17 18 29 21 22	-6.86676 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86674 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673	-6.86678 -6.86678 -6.86678 -6.86677 -6.86677 -6.86677 -6.86677 -6.86676 -6.86676 -6.86676 -6.86676 -6.86676 -6.86677 -6.86677 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678 -6.86678	-6.86686 -6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678 -6.86677 -6.86677 -6.86675 -6.86674 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673 -6.86673	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86686 -0.86686 -0.86679 -0.86679 -0.86677 -0.86677 -0.86676 -0.86674 -0.86674	-6.00084 -6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00083 -6.00082 -6.00081 -6.00081 -6.00081 -6.00081 -6.00087 -6.00078 -6.00078 -6.00075 -6.00074	-6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00085 -6.00084 -6.00084 -6.00083 -6.00083 -6.00083 -6.00082 -6.00081 -6.00081 -6.00089 -6.00077 -6.00077	-6.00087 -6.00087 -6.00087 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00086 -6.00082 -6.00082 -6.00082 -6.00082 -6.00082 -6.00087 -6.00087 -6.00087	-0.60689 -0.60689 -0.50689 -0.50688 -0.50688 -0.50688 -0.50687 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686 -0.50686	-6.66696 -6.66696 -6.66696 -6.66696 -6.66689 -6.66689 -6.66688 -6.66688 -6.66688 -6.66688 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66686 -6.66684 -6.66684 -6.66684	-0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000 -0.00000
se Riser Line N	2 3 4 6 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	-6.86676 -6.86675 -6.86675 -6.86675 -6.86675 -6.86675 -6.86676 -6.86674 -6.86674 -6.86673 -6.86673 -6.86671 -6.86671 -6.86671 -6.86679 -6.86679 -6.86679 -6.86679 -6.86679	-6.86678 -6.96678 -6.96678 -6.96677 -6.96677 -6.96677 -6.96677 -6.96676 -6.96676 -6.96676 -6.96676 -6.96676 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677 -6.96677	-6.86686 -6.86686 -6.86686 -6.86679 -6.86679 -6.86679 -6.86678 -6.86678 -6.86678 -6.86677 -6.86676 -6.86675 -6.86674 -6.86674 -6.86674 -6.86673 -6.86673 -6.86673 -6.86673	-0.86682 -0.86682 -0.86682 -0.86681 -0.86681 -0.86681 -0.86686 -0.86679 -0.86679 -0.86678 -0.86678 -0.86678 -0.86678 -0.86678 -0.86678 -0.86674 -0.86674	-6.00084 -6.50684 -6.50683 -6.50683 -6.50683 -6.50682 -6.50682 -6.50682 -6.50681 -6.60681 -6.60686 -6.50686	-6.00685 -6.50685 -6.50685 -6.50685 -6.50685 -6.50684 -6.50684 -6.50683 -6.50683 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50682 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683 -6.50683	-6.00687 -6.00687 -6.00687 -6.00687 -6.00686 -6.00686 -6.00686 -6.00685 -6.00685 -6.00685 -6.00684 -6.00684 -6.00682 -6.00682 -6.00682 -6.00681 -6.00681 -6.00687 -6.00687	-0.60689 -0.50689 -0.50689 -0.50688 -0.50688 -0.50688 -0.50687 -0.50685 -0.50686 -0.50686 -0.50686 -0.50686 -0.50688 -0.506881 -0.506881 -0.506881	-6.66696 -6.66696 -6.66696 -6.56696 -6.56689 -6.56689 -6.56688 -6.56688 -6.56688 -6.56688 -6.56686 -6.	-0.00092 -0.00092 -0.00092 -0.00091 -0.00091 -0.00091 -0.00090 -0.00090 -0.00090 -0.00088 -0.00088 -0.00088 -0.00088 -0.00088 -0.00088 -0.00088 -0.00088

TABLE 5.3-17, CL2 (BASED ON LINE REF AREA)

		1	2	3	4	8	6	7	8	9	10
	1	-6.86664	-6.80665	-6.88865	-8.86665	-6.00005	-0.00066	-6.66666	-6.00006	-6.66666	-0.0000
	2	-0.00064	-0.00005	-6.00005	-6.60065	-0.00005	-6.50066	-6.56666	-6.00066	-6.00000	-6.00006
	3	-6 . 8666 4	-6.6 066 5	-6.00065	- 6.0000 5	-8.00005	-6.66666	-0.66666	-6.00006	-6.66666	-6.00006
	4	-6.80 0 64	-6 . 6666 5	-6.86665	-6.000 05	-8. 866 65	-8.00066	-Ø.00006	-6.66666	-8 . 56666	-0.86666
·	5	-6.86664	-8.96665	- 6 . 6666 5	- 0 . 000 05	-0. 0000 5	-8 . 8686 6	- 8 . 5666 6	-6 . <i>6666</i> 6	-6 . 6666 6	-8 . 6666 6
ž	6	-6.86664	-6.66665	-6.86665	- 6 .86665	-0. 0000 5	-8 . 6666 6	-6 . 6666 6	-6 . <i>6666</i> 6	- 0 . 5666 6	-0 . 8666 6
a	7	-6.86684	-0.00066	-6.66665	-0.88885	-0.00065	-6 . 66666	-6.88866	-6.86666	-0. <i>8666</i> 6	-0 . 6006 6
ä	8	-6.56664	-6.00005	-6.80005	-0.00005	-0.00065	-8.66666	-0.00006	-6.66666	-0. <i>6000</i> 6	-0 . 96666
•	16	-0.06604 -0.06664	-0.00005 -0.00005	-0.00006 -0.00005	-0.00005	-6.86666	-8.88886	-6.66666	-6.50066	-0.50066	-0.00006
1	11	-6.86664	-0.00005	-0.00005	-0.00005 -6.00005	-0.00005 -0.00005	-6.86665 -6.86665	-6.00006 -6.00006	-6.86666 -6.86666	-6.86066	-6.86666
i.	12	-0.00004	-0.56664	-6.00005	-0.00005	-0.00006	-0.00005	-0.00000	-6.50000	-6.66666	-6.86666
86	13	-6.56664	-6.00004	-6.66665	-6.00005	-0.00005	-0.00005	-0.00000	-6.00000	-6.86666 -6.86666	-8. 8666 6 -8. 8666 6
÷.	14	-6.50064	-6.86664	-6.00005	-6.86665	-8.86665	-0.00005	-0.00000	-0.00000	-6.60066	-0. 8000 6
œ	15	-6.56664	-6.56664	-6.00005	-6.00005	-0.86665	-6.66665	-6.56666	-6.00000	-0.00000	-8.86666
a	16	-6.00004	-6.00004	-0.00065	-6.66665	-0.00065	-8.66665	-0.00000	-6.00000	-0.00000	-6.86666
(Q)	17	-6.66664	-6.66664	-6.66665	-0.00065	-8.56666	-8.00005	-0.00005	-6.66666	-6.66666	-0.00000
.£	18	-6.56664	-6.56664	-6.96665	-6.86665	-6.86665	-6.00005	-6.66665	-6.00006	-0.00000	-0.00006
anw	19	-6.86664	-6.56664	-6.86664	-6.00005	-6.66665	-6.66665	-8.86665	-6.00006	-6.66666	-6.00000
ра	29	-6 . 66684	-6.56664	-6.86664	- 6.6006 5	-6.00065	-6.66666	-6.00005	-6.00006	-0.66666	-0.00006
S	21	-6.86664	-6 . <i>6666</i> 4	-6.86664	- 8 . 666 65	-8 . 6666 5	- 6 . 8666 5	-6. <i>666</i> 65	- 6.8886 5	-6.60006	-0.90006
	22	-6. <i>000</i> 64	-6 . 5066 4	-8.86664	- 0.000 05	-0. 800 65	-6. 866 65	- 6 . 866 65	-6. 8666 5	-6.66666	-6 . 5666 6
	23	-6.00004	-6 . 56664	-6.00064	- 6 . 866 65	-6. 866 65	- 6 . 8666 5	- 6 . 8666 5	-6.66665	-6.66666	-6 . 8666 6
	24	-6 . 566 84	-8 . 5666 4	-6 . 866 64	-6.90004	-6. 866 65	- 8 . 5666 5	- 6.0006 5	- 6 . 2:00 05	-6. 6666 5	-6 . B000G
	•	11	12	13	14	15	16	17	18	19	20
	1 2	-6.00007	-0.56667	-6.96667	-6.66667	-6.56667	-6.60068	-6.60068	-6. 6666 8	-6.66668	-6.86668
•	2	-6.00007 -6.00007	-8.86667 -8.86667	-6.00067 -6.00067	-6.66667 -6.66667	-6.86667 -6.86667	-6.80068 -6.80068	-6.50068 -6.50068	-6.00008 -6.00008	-6.00008 -6.00008	-6.50068 -6.50068
No.	-	-6.00067 -6.00067 -6.00067	-8.86667 -8.86667 -8.86667	-6.86667 -6.86667 -6.86667	-6.66667 -6.66667 -6.66667	-6.86667 -6.86667 -6.86667	-6.80068 -6.80068 -6.80068	-6.50068 -6.50668 -6.50668	-6.00008 -6.00008 -6.00008	-6.00068 -6.00068 -6.00068	-6.00068 -6.00068 -6.0008
Z	2	-6.00007 -6.00007	-8.86667 -8.86667 -8.86667 -8.86667	-6.86667 -6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667 -6.86667	-6.0008 -6.0008 -6.0008 -6.0008	-6.86688 -6.86688 -6.86688	-6.0008 -6.0008 -6.0008	-6.8668 -6.8668 -6.8668	-6.86668 -6.86668 -6.86668 -6.86668
z e	2	-6.86667 -6.86667 -6.86667	-8.86667 -8.86667 -8.86667	-6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667	-6.0008 -6.0008 -6.0008 -6.0008	-6.6008 -6.6008 -6.6008 -6.6008	80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	-6.8668 -6.8668 -6.8668 -6.8668	-6.86668 -6.86668 -6.86668 -6.86668
Z	2 3 4 5	-6.00007 -6.00007 -6.00007 -6.00007	-8.86667 -8.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667 -6.86667	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.0008 -6.0008 -6.0008 -6.0008	-6.86688 -6.86688 -6.86688	-6.8668 -6.8668 -6.8668 -6.8668 -6.8668	-6.8008 -6.8008 -6.8008 -6.8008 -6.8008	-6.00008 -6.00008 -6.00008 -6.00008 -6.00008
ne N	2 3 4 5	-6.00007 -6.00007 -6.00007 -6.00007 -6.00007	-8.80067 -8.80067 -6.80067 -6.80067 -8.80067	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.60007 -6.60007 -6.60007 -6.80007 -6.80007 -6.80007	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.8668 -6.8668 -6.8668 -6.8668 -6.8668	-0.50008 -0.50008 -0.50008 -0.50008 -0.50008	80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	-6.8668 -6.8668 -6.8668 -6.8668	-6.86668 -6.86668 -6.86668 -6.86668
r Line N	2 3 4 5	-6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007	-8.86667 -8.86667 -8.86667 -8.86667 -9.86667 -8.86667 -8.86667	-6.56067 -6.56067 -6.56067 -6.56067 -6.56067 -6.56067	-6.60007 -6.60007 -6.60007 -6.80007 -6.80007 -6.80007	-6.86667 -6.86667 -6.86667 -6.86687 -6.86687 -6.86667	-6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8667 -6.8667	-0.50008 -0.50008 -0.50009 -0.60008 -0.50008 -0.50008	-6.0000.0- -6.0000.0- -6.0000.0- -6.0000.0- -6.0000.0- 80000.0-	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.00008 -0.00008 -0.00008 -0.00008 -0.00008 -0.00008
er Line N	2 3 4 5 6 7 8 9	-6.98867 -6.98667 -6.98667 -6.98667 -6.98667 -6.98667 -6.98667 -6.98667 -6.98667	-0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067	-6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667	-6.00057 -6.00007 -9.00007 -9.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.0008 -6.5608 -6.5668 -6.5668 -6.5668 -6.5668 -6.56667 -6.56667	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
r Line N	2 3 4 5 6 7 8 9	-6.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067	-0.50067 -0.50067 -0.50067 -0.50067 -0.50067 -0.50067 -0.50067 -0.50067	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.50008 -6.50008 -6.50008 -6.50008 -6.50008 -6.50007 -6.50007 -6.50007	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
ser Line N	2 3 4 5 6 7 8 9 16 11	-6.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067	-0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067	-6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667 -6.56667	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0007 -6.0007 -6.0007 -6.0007 -6.0007	-6.00068 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008.0-8.0008.0-9.0008.0008	-6.0008 -6.0009 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
Riser Line N	2 3 4 5 6 7 8 9 10 11 12 13	-6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.90067 -6.90067 -6.90066 -6.80066	-8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -9.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867	-6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067	-6.0008 -6.0008 -6.0008 -6.0008 -6.5008 -6.5008 -6.50067 -6.60067 -6.50067 -6.50067	-6.00068 -6.00068 -6.00068 -6.00068 -6.00068 -6.00068 -6.00068 -6.00068 -6.00068 -6.00067 -6.00067	80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0- 80000.0-	-0.0008.0-08.008.0-08.008.0-08.008.0-08.008.0	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
se Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14	-6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80000 -6.80000 -6.80000	-8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.90067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0007 -6.0007 -6.0007 -6.0007 -6.0007 -6.0007 -6.0007	-6.50068 -6.50068 -6.60068 -6.60068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50067 -6.50067	-6.00008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
se Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15	-6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80066 -6.80066 -6.80066 -6.80066	-0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00057 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007 -6.00007	-6.86067 -6.86067 -6.96067 -6.96067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.0008 -6.5608 -6.5608 -6.5608 -6.5608 -6.5608 -6.56067 -6.56067 -6.56067 -6.56067 -6.56067 -6.56067	-6.50068 -6.50668 -6.60608 -6.60608 -6.50608 -6.50668 -6.50668 -6.50668 -6.50668 -6.50667 -6.50667 -6.50667	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
nwise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.866667 -6.866667 -6.866667 -6.866667 -6.86666	-8.80867 -6.90067 -6.90067 -8.90067 -9.90067 -9.90067 -9.90067 -6.90067 -9.90067 -6.90067 -6.90067 -6.90067 -6.90067 -6.90067 -6.90067	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057 -6.00057	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007	-6.60668 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608 -6.60608	-6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
nwise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15 16	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86666 -6.86666 -6.86666 -6.86666 -6.86666	-0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80068	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00057 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-0.00068 -0.00068 -0.00068 -0.00068 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067	-6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
wise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15 16 17	-6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80066 -6.80066 -6.80066 -6.80066 -6.80066 -6.80066 -6.80066 -6.80066 -6.80066	-0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80068	-6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067	-0.00008 -0.00008 -0.00008 -0.00008 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007	-6.00068 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
panvise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15 16 17 18	-6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.800007 -6.8000000000000000000000000000000000000	-8.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80068 -6.80006	-6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067	-6.0008 -6.0008 -6.0008 -6.0008 -6.50068 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.00068 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-6.5668 -6.5668 -6.6668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668 -6.5668	-6.50068 -6.50068	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
panvise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15 16 17 18 19 28	-6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.800007 -6.800007 -6.8000007 -6.8000000000000000000000000000000000000	-8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80867 -8.80868 -8.80868 -8.80868 -8.80868 -8.80868 -8.80868	-6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667 -6.86667	-6.00067 -6.00067 -8.00067 -8.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067 -6.86067	-6.0008 -6.0008 -6.0008 -6.0008 -6.5008 -6.5008 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.00068 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
panvise Riser Line N	2 3 4 5 6 7 8 9 16 11 12 13 14 15 16 17 18	-6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.80007 -6.800007 -6.8000000000000000000000000000000000000	-8.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80067 -6.80068 -6.80006	-6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067	-0.0008 -0.0008 -0.0008 -0.0008 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007 -0.0007	-6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067	-6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668 -6.8668	-6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068	-6.0008 -6.0008
panvise Riser Line N	2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 28 21	-0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00067 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068 -0.00068	-8.86667 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96067 -6.96068 -6.96066 -6.96066	-6.86667 -6.86667	-6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067 -6.00067	-6.86067 -6.86067	-6.0008 -6.0008 -6.0008 -6.0008 -6.5008 -6.5008 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067 -6.50067	-6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008	-0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008 -0.0008	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008
panvise Riser Line N	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 19 22 22 22	-6.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80067 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068 -0.80068	-0.80067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90067 -0.90068 -0.90068 -0.90068 -0.90068 -0.90068 -0.90068	-6.86667 -6.86668	-6.00057 -6.00057	-6.86067 -6.86067	-0.00008 -0.00008 -0.00008 -0.00008 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007 -0.00007	-6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6068 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067 -6.6067	-6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668 -6.6668	-6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068 -6.50068	-6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008 -6.0008

TABLE 5.3-18, CL3 (BASED ON PARAFOIL REF AREA)

5.4 LATERAL STABILITY STUDY

When the 20 x 60 ft parafoil was tested in the NASA-Ames wind tunnel, four tether lines were attached to constrain the model in roll and yaw, as shown in Figure 5.4-1. Aerodynamic forces and moments were measured through the balance located in the tunnel floor. Missing from these balance measurements were the forces transmitted via the tether lines. The purpose of this study is to include these forces and their contributions to aerodynamic force and moment coefficients.

5.4.1 Resolving Tether Forces

During the wind tunnel test, a load cell was placed on each of the tether lines to measure line tension. To simplify the process of solving for these forces, the first step is to resolve the direction of the lines into unit vectors (UV₁, UV₂, UV₃, UV₄) as shown in Figure 5.4-1. As previously mentioned, the model was constrained in roll and yaw; however, it was allowed to move in pitch with this assumption; the unit vectors are functions of α and the forces are resolved as follows:

$$T_1 \cdot UV_1(\alpha) = T_1x + T_1y + T_1z$$

 $T_2 \cdot UV_2(\alpha) = T_2x + T_2y + T_2z$
 $T_3 \cdot UV_3(\alpha) = T_3x + T_3y + T_3z$
 $T_4 \cdot UV_4(\alpha) = T_4x + T_4y + T_4z$

where T_1 to T_4 are the line tensions, UV_1 to UV_4 the unit vectors, and Tx, Ty and Tz the component forces. (See Figure 5.4-2 for a depiction of these forces.)

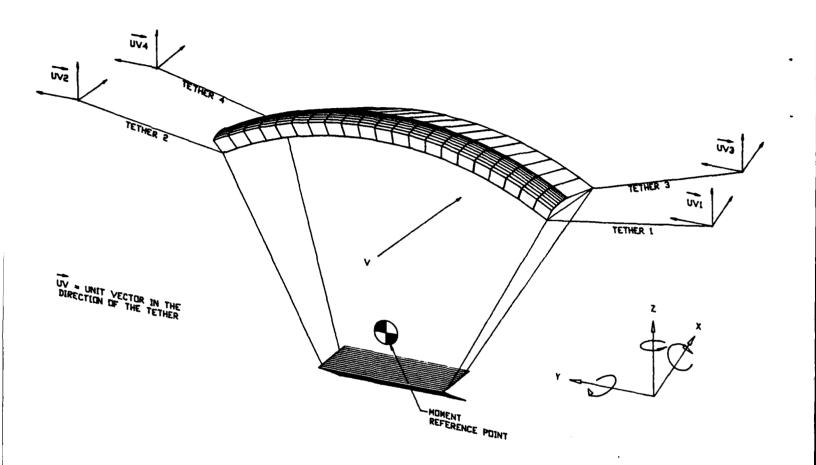


FIGURE 5.4-1, TETHER NOMENCLATURE

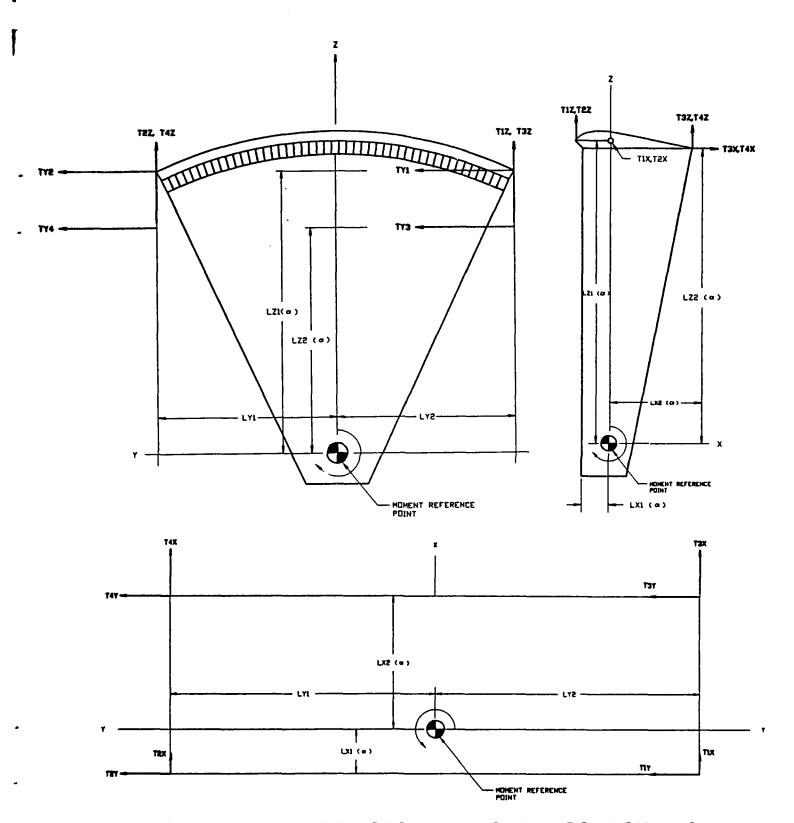


FIGURE 5.4-2, TETHER FORCE AND MOMENT COMPONENTS

5.4.2 Tether Aerodynamic Force Contributions

To add the tether force increments to the measured aerodynamic force obtained from the wind tunnel test the following is used:

$$\Delta D_T = T_1 x + T_2 x + T_3 x + T_4 x (\Delta Drag)$$

 $\Delta L_T = T_1 z + T_2 z + T_3 z + T_4 z (\Delta Lift)$
 $\Delta S_T = T_1 y + T_2 y + T_3 y + T_4 y (\Delta Side Force)$

To translate into coefficient form:

 $C_{DT} = \Delta D_T/qA_{REF}$ $C_{LT} = \Delta L_T/qA_{REF}$ $C_{ST} = \Delta S_T/qA_{REF}$

where q is the dynamic pressure and AREF the reference area of the parafoil (1200 ft²).

5.4.3 Tether Aerodynamic Moment Contributions

To add the tether moment increments to the measured values obtained from the test the following is used:

$$\Delta MXT = -(T_1y + T_2y)Lz_1(\alpha) - (T_3y + T_4y)Lz_2(\alpha) + (T_2z + T_4z)Ly_1 - (T_1z + T_3z)Ly_2$$

$$\Delta MYT = (T_1x + T_2x)Lz_1(\alpha) + (T_3x + T_4x)Lz_2(\alpha) + (T_1z + T_2z)Lx_1(\alpha) - (T_3z + T_4z)Lx_2(\alpha)$$

$$\Delta MZT = (T_3x + T_1x)Ly_2 - (T_2x + T_4x)Ly_1 + (T_3y + T_4y)Lx_2(\alpha) - (T_2y + T_1y)Lx_1(\alpha)$$

To translate into coefficient form:

 $C_{MxT} = \Delta MxT/(q \text{ Aref Lref})$ $C_{MyT} = \Delta MyT/(q \text{ Aref Lref})$ $C_{MZT} = \Delta MzT/(q \text{ Aref Lref})$

where q is the dynamic pressure, AREF the parafoil reference area (1200 ft^2) and LREF the reference length of 20 ft for lateral and 60 ft for longitudinal.

5.4.4 Moment Arm Determination

This section follows the development of equations used in determining the moment arms, as seen in Figure 5.4-2. As stated previously, the model is assumed to be constrained in roll and yaw, but is free to pitch. The moment arms Lz₁, Lz₂, Lx₁ and Lx₂ are therefore all functions of θ_1 , θ_2 , α and α p. The moment arms Ly₁ and Ly₂ are assumed constant. For the remainder of this section follow Figures 5.4-3 and 5.4-4.

Given:

Calculated:

a =
$$(Fu^2 + xx^2 - 2 Fu xx Cos \theta)^{1/2}$$

 $\theta_1 = Cos^{-1}((Fu^2 + a^2 - xx^2)/(2 Fu a))$
 $\theta_2 = Cos^{-1}((Cx^2 + a^2 - Ru^2)/(2 Cx a))$
 $\alpha = \alpha p - \phi + (180 - \theta_1 - \theta_2)$

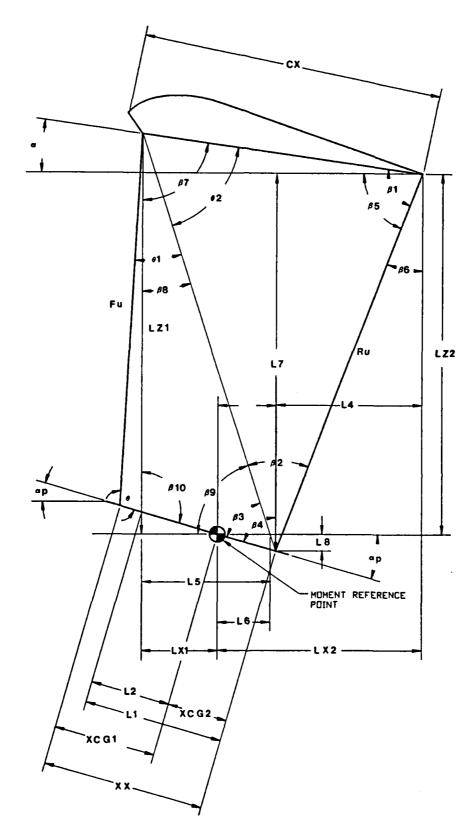


FIGURE 5.4-3, MOMENT ARM GEOMETRY

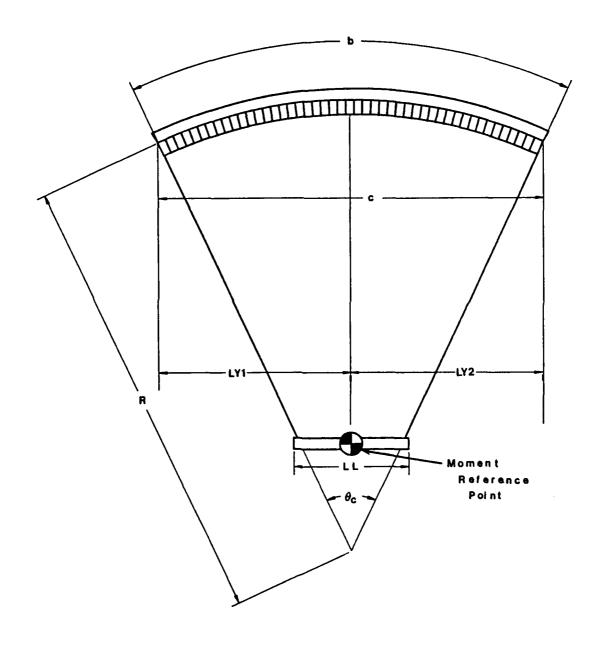


FIGURE 5.4-4, MOMENT ARM GEOMETRY

where the values of Fu, length of forward most suspension line and Ru, length of the rearmost suspension line were defined in a previous study as:

Ru =
$$53.995 - (.3403 + 2(4.1285)^2 - 2(4.1285)(.3403 + (4.1285)^2)^{1/2} \cos((\delta p + 5) + \tan^{-1} (.5833/4.1285)))^{1/2} + .0833$$

Fu = $48.209 - (.3403 + 2(.3942)^2 - 2(.3942)(.3403 + (.3942)^2)^{1/2}\cos((\delta p + 5) + \tan^{-1}(.5833/.3942)))^{1/2} + .0833$

Continuing for the b angles and using the law of sines:

$$\alpha/\sin \beta_1 = Cx/\sin \beta_2 = Ru/\sin \theta_2$$
 $\alpha/\sin \theta = xx/\sin \theta_1 = Fu/\sin \beta_3$
 $\beta_1 = \sin^{-1}((a \sin \theta_2)/Ru)$
 $\beta_2 = \sin^{-1}((Cx \sin \theta_2)/Ru)$
 $\beta_3 = \sin^{-1}((Fu \sin \theta_1)/XX)$
 $\beta_4 = 90 - \alpha\rho$
 $\beta_5 = \beta_1 - \alpha$
 $\beta_6 = 90 - \beta_5$
 $\beta_7 = 90 - \alpha$
 $\beta_8 = \beta_7 - \theta_2$
 $\beta_9 = 90 - \beta_8$
 $\beta_{10} = 180 - \beta_3 - \beta_8$

For the length calculations and using the law of sines:

$$\alpha/\sin\beta_{10} = L_1/\sin\beta_8$$
 $L_1 = (a \sin\beta_8)/\sin\beta_{10}$
 $L_2 = L_1 - XCG_2$
 $L_3 = LCG_2 \cos\alpha\beta$
 $L_4 = Ru \cos\beta_5$
 $L_5 = a \sin\beta_8$
 $L_6 = L_5 - L_2 \cos\alpha\beta$
 $\Lambda = Ru \sin\beta_5$
 $L_8 = XCG_2 \sin\alpha\beta$
 $\theta = b/R$
 $C = 2R \sin(\theta C/2)$

Solving for the moment arms:

$$Lx_1 = L_2 \cos \alpha p$$

 $Lx_2 = L_3 + L_4$
 $Lz_1 = (L_5^2 + a^2)^{1/2}$
 $Lz_2 = L_7 - L_8$
 $Ly_1 = c/2$
 $Ly_2 = c/2$

Solving and substituting in terms of the "given" values:

Lx₁ =
$$((a \sin (90 - \alpha - \theta 2))/(\sin (90-\sin^{-1}(Fu \sin \theta 1/xx)) + \alpha + \theta 2)$$

- XCG2) cos (\alpha p)
Lx₂ = XCG2 cos \alpha p + Ru cos (\sin^{-1}(a \sin \theta 2/Ru) - \alpha)
Lz₁ = $((a \sin (90 - \alpha - \theta 2))^2 + a^2)^{1/2}$
Lz₂ = Ru sin (\sin^{-1}(Fu \sin \theta 2/xx) - \alpha) - XCG2 \sin \alpha p
Ly₁ = R \sin (\theta c/2)
Ly₂ = R \sin (\theta c/2)

5.5 PARAFOIL SCALING EFFECTS

During the Advanced Recovery System (ARS) wind tunnel test at the National Full-scale Aerodynamic Complex, two different parafoils were tested. The largest of the two (20' x 60') was the primary model and was so chosen in order to have the majority of the measured data as close to the full scale drop test size as is possible in the confines of the 80' x 120' test section. The smaller parafoil model was sized in order to be able to evaluate the effects of different size. This would allow corrections to be calculated to properly estimate full scale flight values using the data from the larger parafoil mode.

During the test it was observed that the parafoil assumed a shape that was different from the original design contours. Although not entirely unexpected, it was concluded the magnitude of these distortions precluded the test article from properly modeling the intended design. This in itself is not detrimental because it can be assumed that the full scale parafoil will also distort under load. The problem is that the models and the full scale parafoils may not distort in the same way or in the same

relative amount. Comparison between the two different size models can give insight to this.

It can be concluded that if the two models did not distort in the same way, a proper analysis of the scaling effects cannot be done without determining the effects (parametrically in the wind tunnel) of each of the different distortions. Since it is impractical to measure actual distortions and impossible, from the data obtained, to derive individual contributions, an analytical approach was taken to evaluating the effect of the parafoil model distortions.

5.5.1 Configuration Changes

During the test of the parafoil models, there were seven different distortions identified. The cause of each distortion was determined as was the effect of each distortion.

5.5.1.1 Leading Edge Distortion

During the test the leading edge of the parafoil was observed to be deflected up (Figure 5.5-1). The condition seemed to be worse at higher dynamic pressures. Because of the parafoil configuration and suspension line attachment location the front suspension line of each chordwise row had approximately twice the load as the next several lines behind it. This is verified by the load cell data. The front suspension line has approximately two times the surface area acting upon it as do any of the other lines.

Although the Kevlar lines that were used have a very low modulus of elasticity, they did stretch and the difference in stretch between the front lines and the ones behind them, allowed the leading edge to deflect up.

Line stretch is dependent on the load being applied and the elasticity of the line.

Aerodynamic load is the function of dynamic pressure (q) and characteristic area (S).

The intent during the test was for q to be the same for both parafoil models (sizes) and data are available for comparisons at equal q.

S is four times as large for the larger parafoil as it is for the smaller parafoil.

Line elasticity is dependent on the material, the line diameter and the style or weave. All three of these were identical for the two parafoil models.

Therefore, the leading edge deflection is four times as much for the larger parafoil as it is for the smaller parafoil though the linear dimension is only twice as large. The relative distortion is therefore twice as much in the larger parafoil as it is in the smaller one.

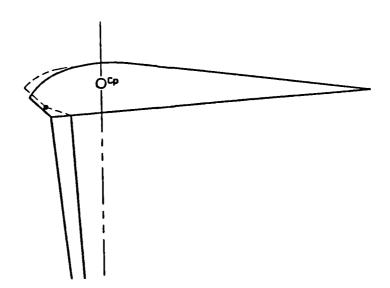


FIGURE 5.5-1, LEADING EDGE DISTORTION

5.5.1.2 Chordwise Foreshortening

Parafoils are rigged such that the payload is positioned forward and the front suspension lines are much closer to being perpendicular to the bottom surface which causes the parafoil to foreshorten (Figure 5.5-2). The foreshortening in turn allows the lines to reach above the nominal attach point producing a convex curve to the bottom surface of the parafoil.

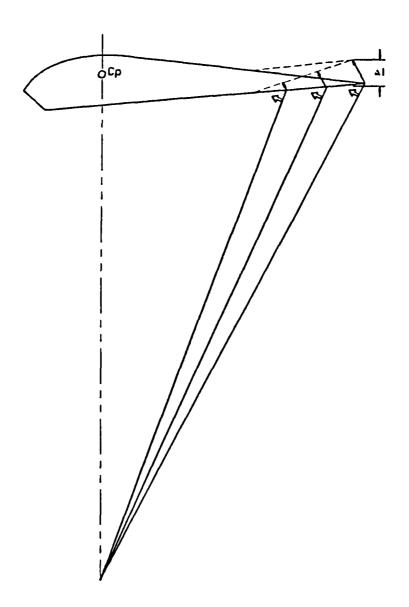


FIGURE 5.5-2, CHORDWISE FORESHORTENING

Prior to Run 5, the suspension lines were rerigged to try and compensate for this. To make the small parafoil similar to the large one, an equivalent/proportional change in rigging was used throughout the time the small parafoil was being tested.

Chordwise foreshortening is a function of suspension line load, line attach angle, rigging and rigidity of the parafoil.

Line Load is dependent on q and S.

q can be selected the same for comparing data and can therefore be considered equal.

S is four times as large for the larger parafoil. Therefore line load would be four times as great.

Rigging was as near identical as could be achieved.

Rigidity of the parafoil is a function of the stiffness of the fabric and the difference in pressure DEL P across the boundaries of the cells.

Assuming no or identical flow separation (which is hard to determine in this situation) the DEL P would be the same.

The parafoil fabric was the same density for both parafoils. Therefore the smaller one was proportionally more stiff. This would lead us to believe that the smaller parafoil should be relatively more rigid. But this was hard to verify by observation of cell shape as will be discussed later.

Therefore, with four times the line load and a linear scale of two, it can be assumed that the relative chordwise foreshortening would be twice as great in the larger parafoil as in the smaller one.

5.5.1.3 Trailing Edge Configuration

In order to ease fabrication of the parafoils, the gore between the parafoil cells was terminated forward of the trailing edge. Therefore there was no attachment between the upper and lower surfaces of the parafoil near the trailing edge. The result was a parafoil which looked like it had a tube running along the trailing edge in the spanwise direction (Figure 5.5-3). In effect, it did.

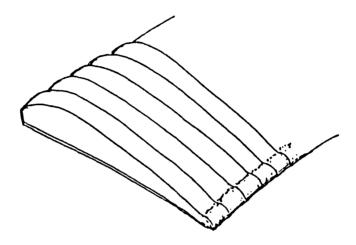


FIGURE 5.5-3, TRAILING EDGE CONFIGURATION

Ignoring the problem of configurational integrity, the concern settles on whether the two different size parafoils had equivalent configurations.

This trailing edge configuration anomaly is dependent on the gore length/attachment and the differential pressure across the fabric.

The gore length/attachment was modeled identically.

Assuming all other factors are the same (which seems to be a poor assumption, but one without an alternative since we do not have pressure data), the pressure differential will be the same, therefore the trailing edge configurations can be considered to be correctly scaled from one model to the other.

5.5.1.4 Trailing Edge Deflection

Parafoils are designed such that local loads are opposed by tension on the individual suspension lines. Under great load the lines are pulled taut. Under light loads, other factors such as line drag can become significant. Near the trailing edge the load distribution goes to near zero. This provides little tension on the trailing edge suspension lines. As could be observed during the test, there was considerably more drag produced bow in the trailing edge lines than in those lines closer to the leading edge. The result of this was that the trailing edge of the parafoil was deflected downward, enough to be noticeable even with the curve up caused by the chordwise foreshortening (Figure 5.5-4). The trailing edge deflection is a function of local parafoil load on the line and of aerodynamic drag acting on the line.



FIGURE 5.5-4, TRAILING EDGE DEFLECTION

As discussed previously, the distributed load is four times as great for the larger parafoil as it is for the smaller one.

The line drag is a function of line diameter, line length and q.

Choosing data for comparison at equal q eliminates q as a consideration.

The line lengths are linearly scaled between the two parafoils although a larger percentage of the length may be exposed to the flow in the test set up of the larger parafoil.

Line diameter is identical for the two sizes of parafoil, which means the line drag would be relatively twice as large for the half linear scale smaller parafoil as it would be for the larger parafoil.

5.5.1.5 Flow Angle

In order to keep flow from impinging on the Parafoil Attitude Control System (PACS) and other attachment hardware, and therefore causing erroneous measurements by the primary balance, a six foot high flow deflector was positioned upstream of the PACS (Figure 5.5-5). This was of little concern with the large parafoil which when being tested was positioned somewhat above the center line of the 80 foot tall test section. With the small parafoil however, there was some concern that the flow deflector could be causing a change in local flow angle and therefore a different and erroneous angle of attack. The test data seem to support this theory. The suspension lines of the smaller (half linear scale) parafoil were half the length of those of the larger parafoil. The effect of this is hard to determine.

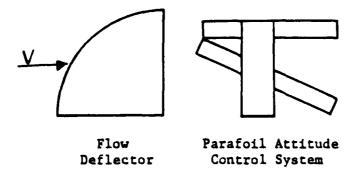


FIGURE 5.5-5, HARDWARE TEST ARRANGEMENT

5.5.1.6 Cell Shape

When a parafoil is in flight the pressure at the open leading edge is at or near the total pressure of the system. Since there are no other air passages, total pressure acts over the entire interior of the parafoil. Since virtually none of the external surfaces are at that high of a pressure, the pressure differential from the outside to the inside is always positive and this causes the parafoil to take its' intended shape. The greater the differential the more "round" the surface of either the top or the bottom of each cell (Figure 5.5-6). Different cell shapes might cause different flow over the parafoil and therefore create different loads. Cell shape is a function of fabric stiffness, and the relationship between pressure differential and spanwise tension.

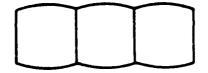


FIGURE 5.5-6, PARAFOIL CELL SHAPE

The fabric weights (stiffness) are the same for both size parafoils, therefore the smaller parafoil is relatively twice as thick and stiff as is the larger one.

At identical q's, the interior pressures will be the same. Assuming the configuration is the same (which again may be a poor assumption), the external pressures will also be the same.

Therefore the pressure differentials across the parafoil fabric will be relatively the same.

The spanwise tension is dependent on q, the wing area (S), wing span (b), and distributed pressures.

q can be chosen to be identical.

S and b are linearly scaled between the two different size parafoils.

Again assuming similar configurations, the pressure distribution should be similar.

The spanwise tension should therefore be properly scaled.

Therefore the only difference in cell shape would be caused by the fabric which should have little or no affect.

5.5.1.7 Spanwise Shape/Length

The spanwise shape of the parafoil is defined by the suspension line length and attach location (Figure 5.5-7). This was properly scaled. Shape can also be affected by any spanwise foreshortening. Spanwise foreshortening would be a direct result of changes of shape in all the individual cells. As was discussed above, it is not believed that cell shape was different between the two sizes of parafoil.

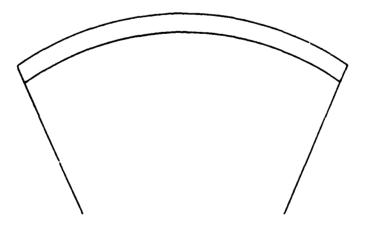


FIGURE 5.5-7, PARAFOIL SPANWISE SHAPE

5.5.2 Summary

The nose shape distortion was relatively twice as great for the large parafoil as it was for the small one. The chordwise foreshortening was also relatively twice as great for the large parafoil. The trailing edge deflection was relatively only half as great for the large parafoil as it was for the small parafoil. Recorded attitudes give cause to believe that the small parafoil was in local flow which was not parallel to the test section floor due to the effects of the flow deflector. Table 5.5-8 gives a summary of parafoil scaling effects.

5.5.3 Conclusion

The trailing edge deflection problem has the least effect due to the small loads in that area. The leading edge shape and chordwise foreshortening, however, are in critical areas and as can be seen in photographs and videos of the test, had significant distortions. Even ignoring potential problems resulting from flow angularity when testing the small parafoil, there were enough differences in configuration between the large (20' \times 60') and the small (10' \times 30') parafoils to preclude a proper evaluation of the effects of scaling.

5.5.4 Recommendations

Data from tests of the larger parafoil should be used in simulations of the full scale ARS parafoils. This is because they are closer to the correct size and also they are not affected by any potential flow angularity problems.

Future models of full scale flight articles should be designed so that distortions will be representative of distortions of the fullscale configuration, taking into account differences in load, fabric stiffness, line stretch, etc.

Parametric tests should be conducted and should use models in some kind of boilerplate configuration.

TABLE 5.5-8, SUMMARY OF PARAFOIL SCALING EFFECTS

EFFECT	SCALING FACTOR		
	Large	Small	
	(20' x 60' Model)	(10' x 30' Model)	
Leading Edge Distribution	4 times small	1	
Chordwise Foreshortening	2 times small	1	
Trailing Edge Configuration	No effect	No effect	
Trailing Edge Deflection	1	2 times large	
Flow Angle	Indeterminant	Indeterminant	
Cell Shape	Little effect	Little effect	
Spanwise Shape	No effect	No effect	

5.6 Sample Results

The information contained in this section is selected examples of the wind tunnel test reduced data. Due to the large quantity of data taken explanations can not be provided for every run, therefore selected examples have been provided to give a overview of the complete results.

The Appendices contain the complete set of results.

5.6.1 Longitudinal Aerodynamics

The aerodynamic data taken during this test was obtained by tether testing techniques to simulate a free flight environment. The data in this report is presented with no correction factors applied to C_L or C_D due to wall interrerence. Computations were done using a 3-D panel code which is a potential flow simulation of the

aerodynamics. The lift correction for the 20' x 60' wing is approximately 7% for C_{Lmax} in flare.

The 20'x 60' parafoil was tested using tether testing techniques where the parafoil was allowed to fly in the wind tunnel. The angle of attack was adjusted by changing the parafoils rigging angle and establishing a new stable trim point. The longitudinal aerodynamic coefficients are an average value taken over a finite period of time. Figure 6.5-1 shows the longitudinal aerodynamic coefficients CL, CD and CM as a function of angle of attack (α) for various dynamic pressures.

The airfoil distortion associated with increasing dynamic pressure caused a decreased lift coefficient and increased drag coefficient.

The angle of attack at which the parafoil stalled was directly related to the dyamic pressure. The parafoil would stall at lower angles of attack with increasing dynamic pressure. This effect can be related with airfoil distortion associated with increasing dynamic pressure. The effects of the parafoil distortion can be seen graphically from the L/D versus angle of attack plots (Figure 6.5-2). The L/D decreases with increasing dynamic pressure and the curves tend to shift to the left with the increasing dynamic pressure. The L/D_{max} can be calculated from the drag polar (Figure 5.6-3). The L/D_{max} of 2.7 is less than the L/D_{max} of 3 that was predicted. An equation for the drag can be obtained from the plot of C_D versus C_L² as in Figure 5.6-4. The parasite drag increases for increasing dynamic pressure while the induced drag remains almost constant.

5.6.2 Flare Aerodynamics

The flare maneuver was accomplished by symmetrically deflecting the trailing edge of the parafoil at a constant angle of attack. Figure 5.6-5 shows how the control force varies with deflection, dynamic pressure and angle of attack. From Figure 5.6-6, it can be seen that both C_L and C_D increase with deflection. The L/D decreased when the wing is flying at high angles of attack; and

L/D increased with deflection at low angles of attack, showing that the flare can be optimized when initiated at low angles of attack.

5.6.3 Load Cell Data

The distributed load across the span of the parafoil was measured by five load cells located along the quarter chord and half the span of the wing. The data points were mirror imaged and a third order curve fit used to determine the spanwise load distribution (Figure 5.6-7). The spanwise load distribution shows how the load increases with increasing dynamic pressure.

The chordwise load distribution was measured by placing twelve load cells along a center span keel. A third order curve fit was used to plot the chordwise load distribution (Figure 5.6-8). The chordwise load distribution can be used to calculate the localized center of pressure location by integrating the load distribution curve and iterating until Xcp is found as in the following equations:

Load =
$$\int_{0}^{c} f(x)dx$$

Load/2 =
$$\int_{0}^{Xcp} f(x)dx$$

Once the center of pressure is found, the lift and drag can be transferred to the quarter chord location and the moment about the quarter chord calculated. Figure 5.6-9 shows plots of Xcp and C_M quarter chord versus angle of attack.

5.6.4 Lateral Aerodynamics

Lateral aerodynamic data was acquired for two different assymetrical control deflections. Figure 5.6-10 shows how the control force is a function of deflection for airfoil local distortion and trailing edge deflection. It can be seen from this graph that the

control force required is approximately equal for both methods. Figure 5.6-11 shows the yawing moment and rolling moment for right side control line deflections. The airfoil local distortion has very little yawing moment and a large rolling moment in the positive right direction. The trailing edge deflection causes the parafoil to yaw in the positive direction and roll in a negative or left direction. This is known as the adverse rolling tendency and is usually associated with large parafoils.

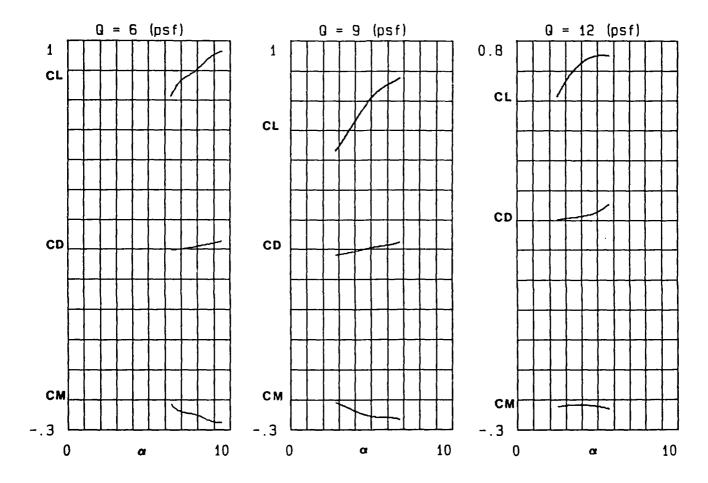


FIGURE 5.6-1, C_L , C_D , AND C_M AS FUNCTIONS OF ALPHA (α) FOR VARIOUS WING LOADINGS

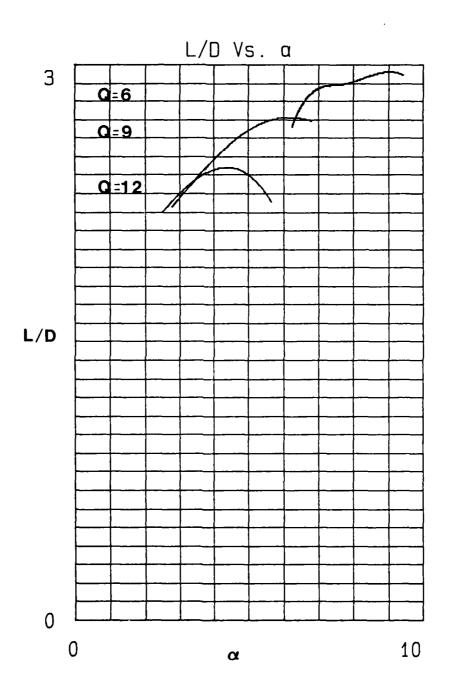


FIGURE 5.6-2, LIFT-DRAG RATIO (L/D) DECREASE WITH INCREASING DYNAMIC PRESSURE

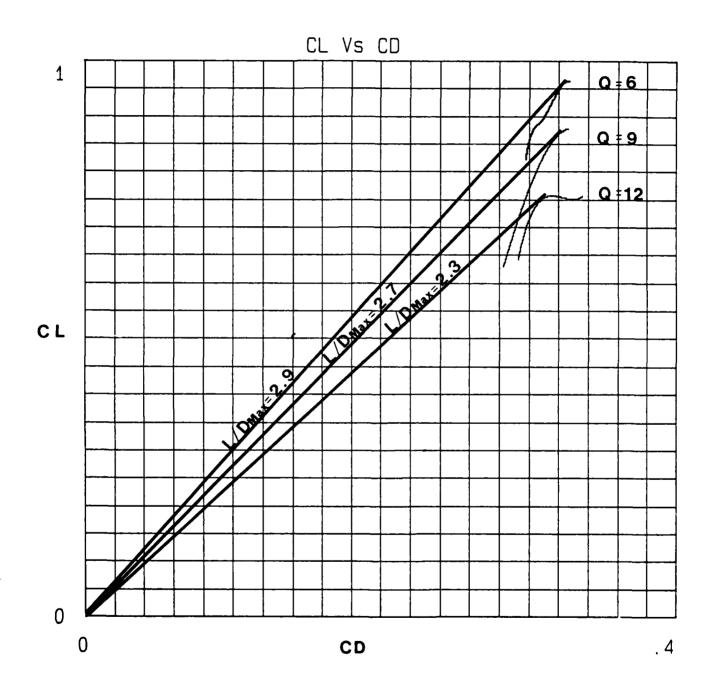


FIGURE 5.6-3, LIFT-DRAG RATIO (L/D) MAXIMUM FROM PLOTS OF C_L VS. C_D

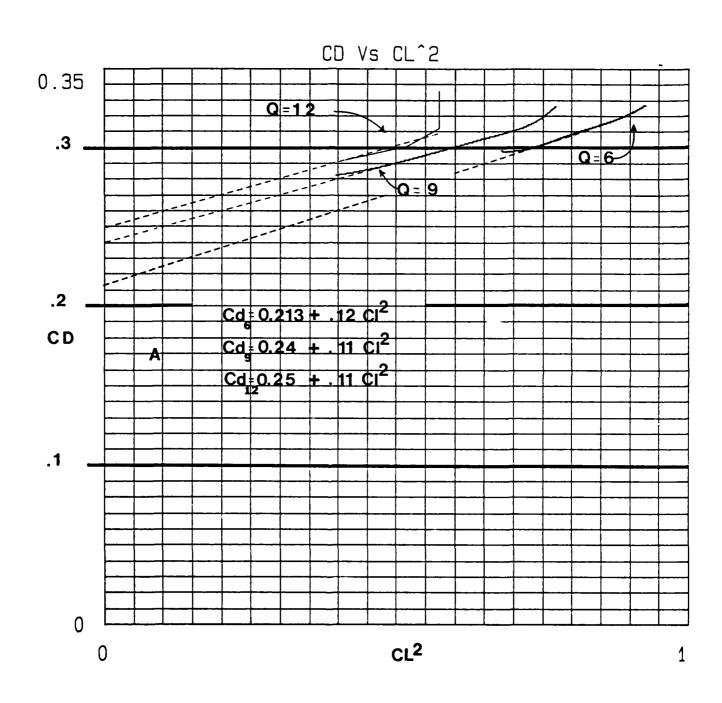


FIGURE 5.6-4, CD VS CL2

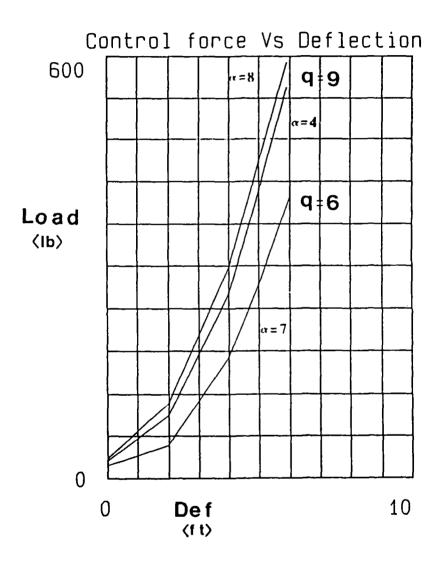


FIGURE 5.6-5, CONTROL FORCE VS. DEFLECTION FOR FLARE MANEUVER

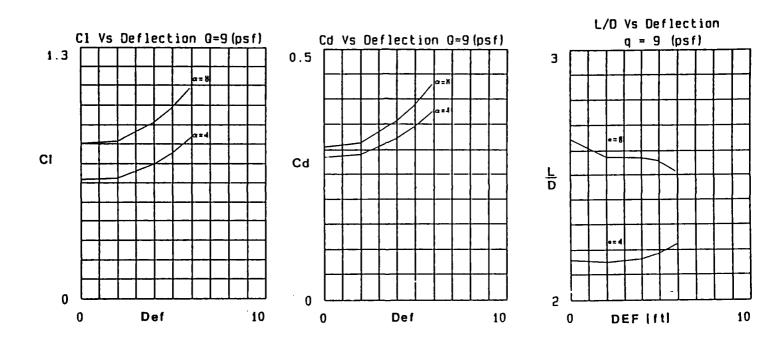


FIGURE 5.6-6, VARIATIONS IN C_L, C_D, AND L/D WITH DIFFERENT DEFLECTIONS AND DYNAMIC PRESSURES

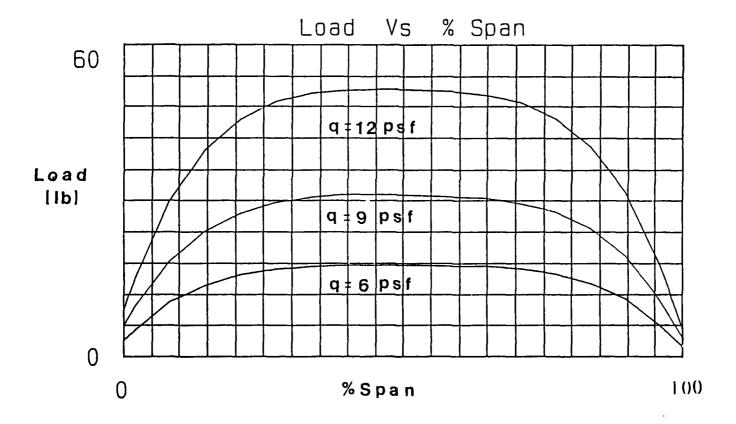


FIGURE 5.6-7, SPANWISE LOAD DISTRIBUTION AT VARIOUS WING LOADINGS

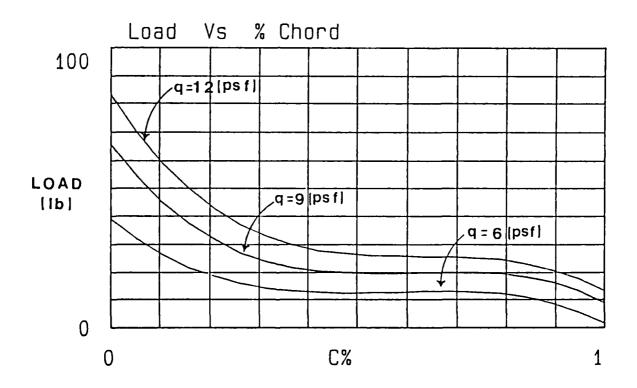


FIGURE 5.6-8, CHORDWISE LOAD DISTRIBUTION AT VARIOUS WING LOADINGS

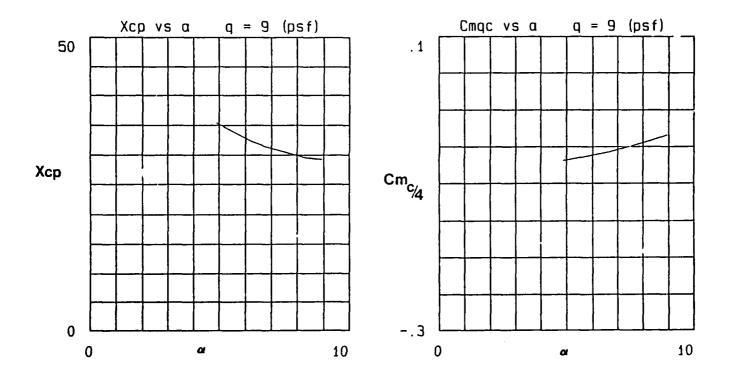


FIGURE 5.6-9, XCP AND CM VS. ANGLE OF ATTACK (α)

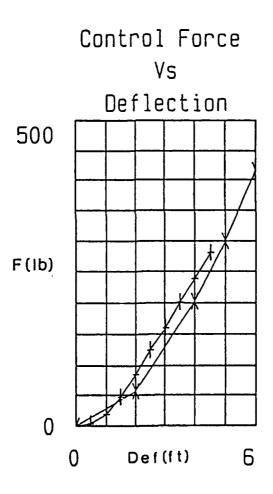


FIGURE 5.6-10, CONTROL VS. DEFLECTIONS FOR TWO CONTROL METHODS

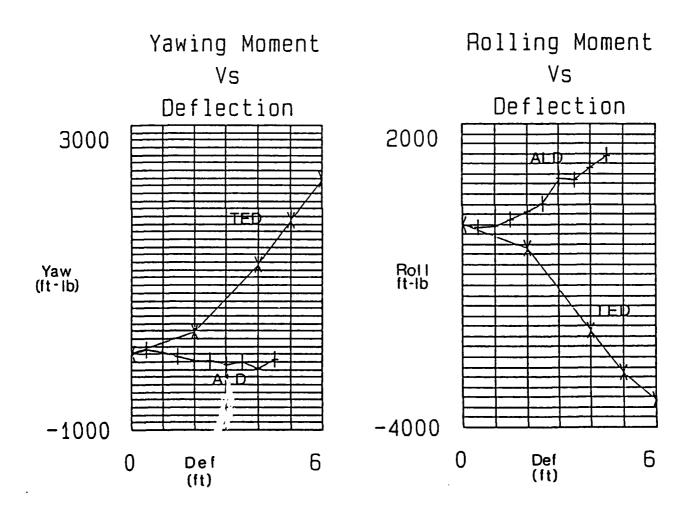


FIGURE 5.6-11, YAWING AND ROLLING MOMENT DATA VS. CONTROL LINE DEFLECTION

6.0 Conclusions and Recommendations

The success of the ARS Phase 2 wind tunnel test exceeded previous expectations. Although scaling effects could not be evaluated aerodynamic data was obtained to support airdrop testing and full-scale development of the advanced recovery system.

Interface hardware, instrumentation and testing procedures have been validated. Structural, operational and safety issues have been addressed.

The major conclusion of phase two testing was that wind tunnel testing of large scale parafoils is practical and useful. Additional testing should be implemented to expand a high glide parafoil data base.

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